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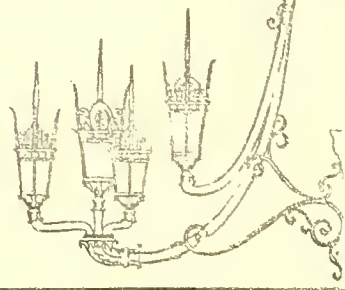
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BOSTON TOMORROW: Background on Development

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For more than two hundred years, Boston was able to accommodate new growth and development through massive landfill projects. In this century, construction of high-rise buildings in our downtown enabled Boston to experience vigorous economic expansion. And in recent years, we have seen the development of new residential areas by imaginative recycling of old mercantile buildings to new housing units. But it is obvious that a city as compact as Boston — and a city whose economy is the engine for the entire metropolitan area — must exercise great resourcefulness in balancing the need for growth with the equally important task of protecting our environment.

This report represents the start of a comprehensive planning process that seeks to manage growth and development in Central Boston. This initial document, containing extensive background data on the downtown economy and growth patterns, provides insight into what patterns we might anticipate in the future.

It is my hope that this report will generate public dialogue that will, in turn, lead to guidelines that protect Boston's character and scale. At the same time, this is a planning process that will also allow us to direct development of new workspace and residential areas towards those parts of downtown which can accommodate additional development.

In documenting Boston's remarkable rebirth, the report provides forecasts for the future and sets forth the complex issues of growth facing Boston. And out of this process — with the collaboration of interested groups and individuals — will emerge the guidelines and principles and concepts that assure us of a vital, distinctive city in the years ahead.

Kevin H. White, Mayor
City of Boston

In spirit and substance this is a report geared to Boston's future. It examines the recent past to determine how the central city has changed and describes the potential for growth in the next ten years. Yet on another level this is a report that addresses a larger question — what kind of city can Boston be?

In one generation we have seen Boston's economy shift from one based primarily on trade and manufacturing to one where finance, business, and professional services now predominate. This economic change has been accompanied by a dramatic improvement in our built environment. Increasingly, Boston has become a more attractive city to live in, a city that draws more and more shoppers, tourists, and convention visitors. Boston, in short, has gone through an era of great change, but Boston has also reinforced its historic role as a center of commerce and culture.

So while this study focuses on the future, it is a plan that integrates an understanding and appreciation of our rich past in charting directions for the Boston of tomorrow.

Robert J. Ryan, Director
Boston Redevelopment Authority

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INTRODUCTION

Last year more dollars were invested on a per capita basis for urban development in Boston than in any other city in the country, and substantial investment is expected to continue throughout this decade. This urban growth and change — an economic resurgence encompassing office, hotel, retail, industrial and residential development — symbolizes a strong local economy with a growing job base and relatively low unemployment.

But changes such as those underway in Boston today are not unique. The evolution from agricultural trade, to manufacturing, to service-based centers has altered the complex relationships of social, economic, and environmental factors which shaped Boston in the past and which shape other cities as well.

What distinguishes Boston's current economic transformation is the rate and magnitude of change. New construction since 1975 has added over fourteen million square feet of space to the physical inventory of Boston, with a record amount of office space built and notable increases in the number of hotel rooms and in the square footage of institutional space.

If economic growth in Boston continues throughout the decade, development required to meet future needs could dramatically alter the cityscape. Expansion within the office sector alone could initiate the construction of eight buildings the size of Sixty State Street between 1985 and 1992; this is in addition to the over four million square feet of office space now under construction.

Such rapid growth raises anew — and with greater urgency — questions about the relationship of future development to the urban design and quality of life in the city. How

should Boston manage this growth to expand employment and housing opportunities, to improve the City's fiscal profile, and to maintain the city's unique character and quality of life?

As the public agency responsible for the physical planning and development of the City, the Boston Redevelopment Authority (BRA) has initiated a study — Boston Tomorrow — to examine the effects of recent development, to forecast future growth, and to establish policies for guiding development over the next decade. The study focuses on the central part of Boston, Boston Inner Harbor and its waterfront, as outlined on the following map. (Parts of the city not included in the study area boundaries are within the planning jurisdiction of Boston's Neighborhood Development and Employment Agency.)

Central Boston is the area of the city undergoing the most substantial development. It is within Central Boston's boundaries that most of the city's commercial and institutional uses are located, as well as much of its rental housing. The area contains over eighty percent of Boston's office space and Boston's three major retail districts. More than half the city's manufacturers and manufacturing jobs are located in Central Boston, as are nearly all of the major educational and medical institutions and visitor-related facilities. Forty percent of the city's apartments and the same percentage of its mixed commercial/residential properties are within the study area boundaries.

Changes in the development process necessitate a process such as the Boston Tomorrow study. For the past two decades, much of Boston's development was managed by the BRA under the federally-funded Ur-

ban Renewal Program. As part of that program, development guidelines provided specific controls on the urban design and architecture of designated areas, including Government Center and the Waterfront. Now that Urban Renewal is no longer a major force shaping the city, most new development results from private initiatives, and is located on sites not governed by Urban Renewal's detailed guidelines.

To maximize the benefits of future development and to minimize the adverse impacts, the City needs to formulate new development guidelines — the purpose of the BRA's study. The guidelines will assist the BRA in its review of development proposals for Central Boston. Such review affords the City the opportunity to manage the impacts of new development in a more comprehensive manner than the zoning process alone would allow. Through its review, the BRA can stipulate design controls, as well as negotiate special agreements which benefit the City, such as the provision of housing, parks, or other public amenities.

The process of formulating development guidelines will consist of two phases. The first phase — this document — presents information on recent development in Central Boston, projections for future growth, and issues to address through development guidelines. The report is organized around the major categories of land use — office, commercial, industrial, institutional, and residential — and the impacts of current and future development of those uses on urban design, environmental quality, energy, infrastructure, and employment. (A companion report, "Boston Tomorrow: Issues of Development", provides similar information but less extensive documentation of the changes

described here.)

The second phase of the Boston Tomorrow project will result in a set of development guidelines representing the BRA's strategy for managing growth in the coming decade.

Complementary studies, as well as public input, will enhance the process of formulating development policies. Several of the studies were initiated or co-sponsored by the BRA. One, "The Downtown Crossing Economic Strategy Plan", was recently completed and provides guidance for improving the downtown retail area. "The Commercial Palace District" is a second development study. Co-authored by the Boston Landmarks Commission, the study recommends establishing a National Register historic district downtown. The first phase of another study, "Parking in Central Boston", was also recently completed. The study analyzes the impacts of new development on the parking supply and suggests how to meet the new demand. A fourth study, "The Central Boston Development Capacity Report", will assess the area's physical ability to absorb new development. In addition, the Greater Boston Chamber of Commerce, through its Boston 2000 Committee, has undertaken a major project to identify development issues facing the City and to seek solutions for them. The "Goals for Boston" project is another effort to establish priorities for Boston's future. Input from all these studies and from public participation noted in the final section of this report will help the City to formulate development strategies for the future.





Introduction

The office sector, principally finance, business and professional services,¹ has assumed a leading role in the creation of new employment in Boston during the past twenty years, and the expansion of the office sector has fostered much of the city's recent development activity, as statistics indicate. Office employment Downtown² has risen by more than fifty percent since 1966, and its growth has helped to maintain the local economy in a period when employment in manufacturing and trade declined. The office sector now accounts for over fifty percent of the total job base in Central Boston and almost one-third of total city-wide employment. Downtown office space, which currently accounts for two-thirds of all office space in the metropolitan area, has expanded substantially.³ Since 1974, approximately 8.5 million square feet of space has been added, 6.5 million square feet are underway or approved for construction.

Comparisons with other cities illustrate the dominance of the office industries within Boston's economy. While Boston is twentieth in population size in the country, it is the seventh largest in the nation in terms of office development, ahead of such cities as Los Angeles, Dallas, and Philadelphia.⁴ With over one thousand financial firms located in the city, Boston serves as a national center for finance, second only to New York.

Indicative of the office sector's strength, the office market outlook through the late 1980s is excellent. The office space surplus of 1976-1978 has disappeared. Between 1979 and 1983, there has been an extreme shortage of office space, accompanied by a rise in rents and even a loss of existing firms and employment

from the city to the suburbs. Currently, the vacancy rate in Class A structures is 1.5 percent. Low vacancy rates have led to significant levels of new construction and rehabilitation activity. While vacancy rates may rise over the coming two years, a strong market for new construction and rehabilitation is expected to continue.

This section presents an overview of the role of the office industry in Central Boston today, analyzes recent activities in office development, and presents projections for office development over the next decade.



CURRENT STATUS OF BOSTON'S OFFICE SECTOR

• Office Development

The resurgence of the city's economy and the growth of services was made most visible by the boom in new office construction since 1960. The private office stock increased by over seventy-five percent, from approximately twenty-two million square feet in 1960, to approximately thirty-nine million square feet by mid-1983.

The City's federally-funded Urban Renewal Program, in concert with dramatic employment growth in the finance and business sectors of the local economy, fueled much of this new development. Even in the absence of Urban Renewal funds, construction of office space has continued. Between 1974 and the beginning of 1983, approximately 8.5 million square feet of office space was completed.

As office vacancy rates declined, local office developers turned to the rehabilitation of structures to quickly bring additional space on line. The scarcity of land downtown for new construction, the special protection given buildings of architectural significance which discourages demolition, and the shorter lead time for rehabilitation and conversion projects made rehabilitation a competitive alternative for the development community. Since 1975, over 4.5 million square feet of office space has been upgraded to Class A quality. The rehabilitation of older office space will probably continue at lesser pace in the late 1980s, as more new office

space comes available and the amount of space suitable for upgrading diminishes.

At present, about 6.4 million square feet of new office space and 1.4 million square feet of rehabilitated Class A space is scheduled for completion over the next three years. (Table 1 in the Development Appendices outlines the new office construction and rehabilitation completed between 1975 and 1983 and the projects scheduled for completion by 1987.)

The majority of the office space constructed prior to 1976 was in buildings sponsored by major financial institutions. Speculative office construction, which was limited to the moderate and smaller-sized developments, accounted for only twenty percent of total office space between 1965 and 1975. Since 1976, most of the office space to come on line, and virtually all of the major developments presently under construction or proposed, are speculative.

The growth in office space downtown runs counter to trends seen in other large metropolitan areas where the suburbanization of office development has been a significant factor. In Boston, the downtown area has retained the majority of the metropolitan area's office stock. Approximately two-thirds of all office space in the region is located in Central Boston. The city also has captured a significant share of new office construction in the region; from 1971 to 1975, Central Boston captured seventy-two percent of the thirteen million square feet of new office space built in the

region. Since 1976, the capture rate has been approximately sixty percent. Moreover, this office market has consistently had lower vacancy rates than the suburban market.

• Current Office Space Supply

The analysis of Central Boston's office space supply is based on an inventory of four districts delineated on Map 2. The office space inventory encompasses the Government Center, Financial District, Midtown, and Back Bay. Space in these areas can be classified into three types: Class A—built since 1960; Class B—older space that has had major renovations and is competitive with new space; Class C—older space with some modernization and upgrading. (Class D—older space with little or no improvement—is now nearly non-existent in Central Boston. It is included in Class C figures.) Class A private office space accounts for forty-two percent (16.7 million square feet) of the current office market, Class B for twenty-three percent (9.1 million square feet), and Class C for thirty-five percent (13.6 million square feet.)

An office industry study⁵ noted that in 1982 Boston's first class office buildings were renting at an average of twenty-nine dollars per square foot, in a range from about twenty-three dollars to forty dollars, and that the newest office space is renting at an average of thirty-two dollars, in a range of twenty-seven dollars to forty dollars per square foot.

The Financial District has the

largest concentration of private office space with twenty-one million gross square feet (fifty-five percent of total stock). Office space constructed in this district accounted for over sixty percent of the new office development in Boston between 1960 and 1982.

During the past five years, the majority of new Class A office construction or rehabilitation activities has been concentrated in the Financial District. This district continues to be the greatest in demand by financial and business services firms. Almost all of the new office development currently proposed or underway is located in the Financial District and immediately adjacent areas.

The Back Bay is the second largest market area, but significantly smaller than the Financial District, with eight million gross square feet of office space. Twenty-five percent of the city's office space built between 1960

and 1982 was constructed in Back Bay.

The remaining two office centers, the Government Center and Midtown areas, have smaller concentrations of competitive office space with 4.8 and 4.4 million square feet, respectively. These two areas differ in their characteristics. In Government Center, as its name implies, new public office space predominates, and the Midtown area's office stock is primarily private, unrenovated, older space at the present time.

• Office Employment

Today nearly 290,000 workers are employed in Central Boston. Over half of these people, 175,000, work in competitive (privately-owned) office space.

Between 1976 and 1982, employment in offices grew from 148,000, to 175,000 jobs,⁶ and new office jobs accounted for sixty-nine percent of the jobs created in Central Boston. The

major growth industries, as Table 1-1 indicates, have been business and professional services; and finance, insurance, and real estate.

Most office sector jobs are concentrated in professional and clerical positions. In 1980, clerical jobs numbered approximately sixty-four thousand (forty-two percent of total private downtown office workers). Professional workers (engineers, accountants, lawyers, printers, etc.) filled fifty-eight thousand jobs, accounting for thirty-eight percent of the total workforce.

In 1982, Boston residents held twenty-six percent of the total numbers of jobs in the private office sector downtown. This is in contrast to their capture rate of thirty-five percent of all jobs city-wide. Residents of the city, however, have been capturing an increasingly larger share of the higher paid professional jobs. Between 1960 and 1982, the number of professional jobs

Table 1-1 Central Boston Office Employment Trends 1976-1982

	1976	1977	1980	1981	1982	1976-1982 Change	
						Number	Percent
Agriculture & Mining	80	70	66	59	64	-16	-20%
Construction	1,777	1,560	2,005	2,046	2,057	280	16
Manufacturing	5,172	5,240	5,036	4,934	4,823	-349	-7
TCPU*	24,028	23,230	25,810	26,243	25,269	1,241	5
Trade	4,929	4,490	4,828	4,832	4,668	-261	-5
FIRE**	42,378	43,150	47,977	50,691	52,247	9,869	23
Services	49,235	52,660	61,392	63,801	64,376	15,141	31
Business	15,157	13,760	18,900	19,641	19,818	4,661	31
Professional	34,078	38,900	42,492	44,160	44,558	10,480	31
Government	16,413	16,600	18,529	18,272	16,947	534	3
Proprietors	4,124	4,240	4,594	4,739	4,673	529	13
TOTAL	148,136	151,240	170,237	175,617	175,124	26,988	18%

Data does not include government workers in public buildings. Data does not include Fenway-Kenmore, Charlestown, South Boston.

* Transportation, Communications, Public Utilities.

** Finance, Insurance, Real Estate.

Source: U.S. Census Bureau, County Business Projections; Bureau of Economic Analysis, Employment Series; Boston Redevelopment Authority, "The Office Industry Survey," 1979 and "Boston's Office Industry," 1981.

held by residents increased from 12.5 percent to twenty percent of total city resident employment, partly a result of the changing demographic profile of residents. Boston residents, however, still comprise a higher percentage of non-professional office workers than their suburban counterparts.⁷

- Current Demand For Office Space

The current demand for office space results from the creation, expansion, and migration of companies. Expansion of existing firms has accounted for approximately sixty-three percent of recent demand for new office space, while new companies forming in Boston accounted for twenty-four percent of total demand (mostly within Class C buildings, which provide smaller and less expensive space).⁸ Firms moving to the city played a small role in the private office market, accounting for only thirteen percent of total demand. Such firms have tended to be small (average size of nineteen employees) but more recently, new firms have been larger than in the past. These firms, primarily finance/insurance/real estate and professional services, have preferred Class A and B office space. They moved to Central Boston to improve access to clients and support services, or to upgrade company image. They locate primarily in the Financial District, the center for New England banking and an area recognized for its concentration of finance and service firms.

Two measures of the current demand for office space are

vacancy and absorption rates. Vacancy levels measure the relationship between supply and demand and basically indicate how the office market is operating. High vacancy rates often discourage new development, as well as the maintenance of older structures. Alternatively, they may lead to the conversion of marginal office structures to residential and other non-office uses. Low vacancy rates, as the current office economy now demonstrates, encourage new development and the conversion or upgrading of marginal structures into higher rent space. Prior to the supply of new space, expanding firms are forced to either delay growth or seek space outside of the city. As rents rise across the board due to the tight market, some less profitable firms may leave their urban locations for less expensive space elsewhere. A minimum vacancy rate assumed to allow the market to operate normally, is generally thought to be about five percent.

Currently Boston has one of the lowest office vacancy rates of any major U.S. city. Vacancies in the downtown area are 1.5 percent for Class A office space and 5.1 percent overall for all classes. According to a 1982 survey, the Class A vacancy rate was similar to those found in Los Angeles and Washington, D.C., while Atlanta, Denver and Fort Worth each had Class A vacancies of over ten percent.⁹

From 1963 to 1970, when the national economy was growing and Central Boston's employment expanding rapidly, office vacancy rates decreased signifi-

cantly from seven percent in 1960, to two percent by 1970. During this same period, over five million square feet of new space was added to the downtown office stock.

Since 1970, a combination of accelerated office space development, continued expansion of the service sector, and two major national recessions have caused significant fluctuations in the vacancy rate, as Table I-2 indicates. The vacancy rate peaked in 1977 at fourteen percent with the completion of 6.5 million square feet of office space in 1975 and 1976.

The annual office space absorption rate provides an indicator of the level of demand at a point in time and records how fast new space is being leased. It also is used to evaluate whether the amount of new space in the pipeline responds to the short-term needs of the market.

Absorption, while somewhat different than demand, is one approximate measure of the square footage demand for office space in any given year. Interpretations vary depending on whether a rate refers to a past situation or the future. Referring to the past, absorption rates measure the amount of new office space leased over a given period of time. Limited space availability can thus lead to an absorption rate which under or over represents total demand. Absorption rates which apply to a future situation represent projections of demand based upon net job growth, replacement of demolished space, and changes in office space requirements.

Table I-2 Central Boston Office Vacancy Rates
(CBD and Back Bay)

	Percent Vacant Total	Percent Vacant By Class
April 1975	7.3%	
October 1975	7.5	
April 1976	11.5	
October 1976	12.1	
April 1977	15.1	
October 1977	13.6	
April 1978	10.1	
October 1978	9.1	A 6.1%
		B 11.5
		C 16.5
April 1979	7.3	A 4.4
		B 14.1
		C 14.0
October 1979	4.4	A 1.2
		B 6.3
		C 17.7
April 1980	3.1	A 1.2
		B 4.4
		C 10.4
October 1980	3.25	A 1.4
		B 3.6
		C 11.7
April 1981	2.2	A 1.4
		B 2.3
		C 7.1
October 1981	2.1	A .7
		B 2.2
		C 6.5
April 1982	3.2	A 1.4
		B 1.9
		C 8.1
October 1982	3.6	A 1.7
		B 8.4
		C 19.1
April 1983	5.1	A 1.5
		B 8.2
		C 19.1

Source: Building Owners and Managers Association, Biannual Occupancy Survey. Compiled by Boston Redevelopment Authority.

During the past five years, the downtown office market had an average annual absorption rate of over 900,000 square feet per year. In comparison, the average annual absorption rate from 1971 to 1975 was over 1.2 million square feet, primarily due to the large amount of office space that came on line in that period. In 1982, one million square feet of office space was absorbed.

FUTURE GROWTH OF BOSTON'S OFFICE INDUSTRY

Boston's office sector will continue to expand throughout the 1980s. The anticipated growth in employment, the continuing attraction of Boston as a location for office businesses, and the changing characteristics of office space use will all generate future demand for office space. According to BRA projections,

Table I-3 Central Boston Office Space Absorption Rates
(in square feet)

1976	1,096,400
1977	710,100
1978	1,113,300
1979	720,000
1980	1,100,000
1981	1,275,000
1982	870,000
1983	1,500,000

Source: Coldwell Banker, Commercial Brokerage Company, 1976-1979
Spaulding and Slye Office Report, 1980-1983.
Boston Redevelopment Authority, 1983.

between ten and thirteen million square feet of additional office space will be needed between 1983 and 1992. (Table I-4 provides more detailed figures for the demand projected for office space.) Some of that demand will be met by the over five million square feet of new and rehabilitated space scheduled for completion by the end of 1986. This new development compares favorably to office growth in other major U.S. cities.

Houston, which has a similar size office market but a higher vacancy rate, reportedly has approximately eight million square feet of office space under construction. Chicago, with a much larger office space base, will also add eight million square feet to its downtown's ninety million square feet of space within the next two to three years. New York City is expected to add approximately seven million square feet of new office space in the next few years.

The space added to Boston's office stock has helped to even out the market and should con-

Table I-4 Projected Office Space Demand 1982-1992
(in millions of gross square feet)

Class	1982	1992	1982-1992
A	16.5	29.1	+ 12.6
B	6.3	7.8	+ 1.5
C	16.6	15.5	+ 1.1
TOTAL	39.4	52.4	+ 13.0

Note: Projections for the 1992 demand for office space are based on the anticipated increase of 40,512 jobs in offices (generating the demand for 9.7 million square feet), a potential increase in office space standards from 240 square feet per employee in 1982 to 250 square feet (generating the demand for 2.3 million square feet), and a vacancy factor of five percent (accounting for one million square feet of office space).

Source: Boston Redevelopment Authority.

tinue to do so for the rest of this decade. Between 1979 and 1981, office space was in short supply, causing rents to increase and causing some of the city's office tenants to relocate in the suburbs. In contrast, the market between now and 1986 should normalize with the addition of 6.5 million square feet of new space and with the continuation of a strong demand for that space.

Several national and local trends lie behind forecasts for the growth of Boston's office space. First, many of Boston's office businesses are in sectors which are experiencing growth nationwide. Banking, insurance and investment services, business management, administrative, and consulting services, as well as accounting, engineering, legal, medical, educational and other professional services are examples of such industries. Based on trends in the U.S. economy, at least seventy-five percent of Boston's employment growth during the coming ten years will be in services, finance, and communications sectors.¹⁰ Office employment in Boston is projected to reach 209,000 jobs by 1992, an increase of 34,000 jobs from the 1982 level.

Second, Boston had become an attractive location for the office industry. Several factors account for this: It is the hub of a region growing in employment and population; Boston is a national center for education, medicine, and other professional services; it draws on the regional expansion of high technology industries; and it offers retail and cultural attractions. Other factors include the substantial private investment in Central Boston, the rising competitive advantage of a downtown location, the unabated interest expressed by potential renters and builders, and the recent reputation of Boston as a stable office market. In combination, these factors should help to maintain a significant level of demand for office development.

Third, the composition of office space stock, the distribution of employment within office space, and the average size of occupied space, have been changing in Boston during the last two decades. In 1970, due to the limited building that occurred in the 1960s, only twenty percent of the stock was Class A, twenty percent Class B, and sixty percent Class C. By 1982, the distribution changed to forty-two percent, twenty-three

percent, and thirty-five percent for A, B, and C, respectively.

Another feature of office use that has been changing over time is the amount of office space occupied per employee. Both in Boston and the U.S., the amount of space per worker has been gradually rising. In Boston the average gross square feet per employee ratio rose from 209 in 1966 to 240 in 1982. Expressed as net rentable square feet per employee, the rise from 1976 to 1982 was from 182 to 192. According to a Building Owners and Manager's Association (BOMA) international survey of office buildings, the U.S. average of net rentable square feet to employee increased from 187 in 1975 to 197 in 1979. Thus, both local and national use has reflected the trend toward larger office space requirements. The costs of energy, however, may halt this trend.

Employment growth, the desirability of Boston as a business location, and the changing characteristics of office space use are factors which together will generate future demand for additional office space with Boston. Using the projections of employment and office space use, it is possible to project the demand

for office space by class. Given the present square foot use of space per employee and number of new employees, total new 1982-1992 demand for Class A office space would be 12.6 million square feet. Based upon recent leasing activity, almost twenty-five percent of employment growth would be due to firms new to the city, with seventy-five percent originating from expansions of existing firms. The expanding firms would, in general, demand Class A space, and the new firms are expected to demand Class B and C space. A demand for an additional two million square feet of Class B space and 1.5 million square feet of Class C space is projected.

Six million square feet of the demand for additional office space is likely to be met from between 1983 and 1986 and up to seven million between 1986 and 1992. Growth during the first period is due in part to pent-up demand from prior years and greater employment

growth. The demand during the late 1980s will arise from the anticipated increase in office employment.

DEVELOPMENT ISSUES

The projections for continued growth in the office sector will have a positive effect on other sectors of Central Boston's economy and for the city as a whole. Business visitors are a major component of the city's expanding hotel sector and likewise, office workers are a major component of Central Boston's captive retail market. Their increasing numbers in recent years have helped to reverse the decline in retail sales, to fill new hotel rooms and to generate additional interest in housing downtown.

While office sector growth has bolstered other local businesses and has helped to generate new jobs, it has also benefited the City's fiscal profile. Revenues derived from office buildings contribute substantially to the local

property tax base and have helped to reduce the property tax for residential owners.

The location of new office projects can support the City's efforts to redevelop underutilized areas, such as portions of Washington Street, North and South Stations, and some places in the Financial District. With the reductions in Federal funds and the budget limitations imposed by Proposition 2½, the City will rely even more on office developers to provide public improvements formerly undertaken by the City to revitalize such areas, both in Central Boston and the neighborhoods.

Recent initiatives from the BRA have led to the contribution of housing funds from downtown commercial projects. The Arlington-Hadassah development will contribute a minimum payment of 600,000 dollars, and the Rowes/Fasters Wharves project will provide 500,000 dollars annually as part of its lease agreement with Boston. The funds will be used to generate housing opportunities for low and moderate income households.

Despite the current and potential benefits of the office boom, the growth is not without its adverse impacts. Some of these are outlined in the Environmental Quality and Design sections of this report and include excessive levels of wind and noise, shadows cast by tall buildings, and degradation of air and water quality, as well as aesthetic issues of urban form.

Because the market for office space is strong, office developers can frequently pay more than existing or potential users

Table 1-5 Projected Downtown Office Employment 1982-1992

	1982	1992	1982-1992 Change Number	Percent
Agriculture & Mining	64	65	1	2%
Construction	2,057	2,565	508	25
Manufacturing	4,823	5,301	478	10
TCPU*	25,269	27,962	2,693	11
Trade	4,668	5,408	740	16
FIRE*	52,247	64,138	11,891	23
Services	64,376	83,667	19,291	30
Business	19,818	26,302	6,484	33
Professional	44,558	57,365	12,807	29
Government	16,947	16,164	-783	-5
Proprietors	4,673	3,902	-771	-16
TOTAL	175,124	209,172	34,048	19%

* Transportation, Communication, and Public Utilities.

** Finance, Insurance, and Real Estate.

Source: See Table 1-1.

of downtown property. This situation can result in pressure to demolish older buildings, sometimes threatening the city's architectural heritage. There is pressure on manufacturers to relocate, which threatens peoples' jobs and the diversity of the local economy. There is pressure as well on the residential stock, occasionally through demolition but primarily through the inability for residential developers to compete for space.

The amount, timing, forms and location of office development requires careful management by the City. The use of the development strategy and guidelines for Central Boston will further assist the City to maintain the current stability of the office market and will maximize the potential benefits of office development for Boston.

6. Downtown office employment growth has not been consistent throughout this period. Large increases in office employment occurred between 1969-1972 (seventeen thousand new jobs) and 1976-1980 (eleven thousand new jobs). Between 1972-1976, however, only eight thousand new jobs were created in the office industries.
7. This correlation is very strong within each of the occupation categories with the exception of offices for manufacturing, trade, and business service firms.
8. Boston Redevelopment Authority, "Office Industry Survey, Part II, Analysis of Office Tenant Responses", March 1979.
9. Office Network, Inc.
10. Boston Redevelopment Authority, "Boston Office Industry: A Long-Term Perspective" (currently in draft).

NOTES

1. Growth sectors in the office industry include finance, business and professional services and are the sectors generally referred to in this report as the office industry. However, office jobs are found in all sectors of the economy. Statistical information contained in this report includes employment data for all sectors in Boston.
2. When statistical information is used in reference to "Downtown", it includes data collected from the Central Business District and Back Bay.
3. Between 1930 and 1960, only three million square feet of additional office space was built in the downtown, and most of it was housed in one major building, the John Hancock Insurance Company's home office on Berkeley Street. This construction slowdown was brought on by the Depression and World War II. Subsequently, Post War suburbanization and expressway construction which encouraged the move of both commerce and industry to the suburbs, further discouraged new investment in the City and led to significant deterioration. New development followed after the commencement of the City's Urban Renewal Program.
4. Urban Investment and Development Company, Downtown Indicators Report, Chicago, 1983.
5. Office Network, Inc., "National Office Market Report."

Introduction

Boston historically has served as a major regional retail center, attracting people who live and work in the city, as well as those from the suburbs. Today the city, and Central Boston especially, remains the foremost shopping area in the region, although retail activity suffered between 1948 and 1977 from national demographic trends and economic fluctuations. Growth in other commercial sectors; an increase in residents downtown and higher per capital incomes of those residents; and new marketing strategies have helped to boost retail sales after several decades of decline. For the next decade, prospects for retail trade look even brighter, based on growth forecasts for employment, tourism, and residential development in some Central Boston neighborhoods.¹

Promoting retail growth is an important component of the City's development strategies because of the significant contribution retail activity makes to the economic and social vitality of Boston. The retail sector serves a major role in supporting and stimulating other commercial and residential uses; it creates jobs for Boston residents; and it increases property values and City tax revenues. By guiding the location and form of major new retail development, the City can more effectively implement its efforts to revitalize some areas of Central Boston.

This chapter provides information on the present characteristics of retail trade in Central Boston and forecasts trends for the future. Outlining the issues related to retail development that face the City today, as well as strategies successfully employed to deal with them in recent years, the information should help in formulating development policies to guide future retail growth.

CHARACTERISTICS OF RETAIL ACTIVITY

The Boston metropolitan area, with sales totaling nine billion dollars, is the major retail center in New England. Retail sales in the city itself totaled nearly two billion dollars in 1977 (the latest year for which complete data is currently available); a major portion of this activity was concentrated within Central Boston.²

Between 1948 and 1977, retail trade in the city declined as the population increased in the suburbs. This population shift, predominantly an exodus of middle and upper income groups, caused the city's retail market to shrink in terms of relative affluence, as well as size. While the median family income for the SMSA increased by nearly ninety percent, that of Boston's residents increased by less than forty percent between 1949 and 1978.³ Suburban retail space grew to meet the increased demand in outlying areas. As a result, Central Boston's major retail district's share of the total Statistical Metropolitan Area's (SMSA) retail sales dropped from twenty percent to 6.5 percent.

Despite this metropolitan shift (a pattern seen nationwide) and a decline in retail sales, Boston has remained the major regional retail center. Central Boston has approximately 5.8 million square feet of gross leasable retail area, including that occupied by retail stores, eating establishments, and cinemas. This exceeds the amount found in any other area of the region and is twice the scale of the largest suburban grouping — the combination of the North Shore Shopping Center and Liberty Tree Mall.⁴

The character of retail activity in Central Boston and its role as a regional center is more clearly indicated when the composition of Central Boston's retailing is compared to that of the metropolitan area as a whole. While such "heavy merchandise" categories as building materials, automobiles, and related goods account for approximately twenty-five percent of regional retail sales, these categories constitute very little of the retail sales in the downtown area. Instead, Central Boston serves as a regional center for consumer-oriented retailing — comparison merchandise, restaurants and

entertainment — as well as food and convenience items. Currently, approximately twenty percent of all comparison goods sales in the Standard Metropolitan Statistical Area (SMSA) are made in Central Boston. Comparison goods include apparel, general merchandise, furniture and home furnishings, and miscellaneous goods. In 1977, Central Boston's regional share of restaurant sales was well over ten percent.⁵ That figure predates the full operation of Faneuil Hall Marketplace, which derives over half its sales from restaurant business. Restaurant activity is becoming an increasingly important component of Central Boston's retail sector.

Recent trends have led to increased sales, and the city is likely to continue as the major regional retail center. The long-term trends of suburban economic and population growth have stabilized, dampening the rate of growth in retail sales in the suburban areas of the SMSA during the past decade. Also, Boston's captive market — its workers, visitors, and residents — has grown, compensating for the loss of traditional markets.

Table II-1 Trends in Retail Sales 1958-1979 (in millions of dollars)

	1958		1963		1967		1972		1977		1979	
	A*	B**	A	B	A	B	A	B	A	B	A	B
Boston SMSA	\$3,248	\$6,982	\$3,819	\$7,562	\$4,671	\$8,361	\$6,829	\$9,697	\$9,271	\$9,271	\$11,158	\$9,596
City of Boston	1,241	2,668	1,191	2,358	1,382	2,475	1,624	2,307	1,832	1,832	2,184	1,878
Downtown Boston												
Total	450	968	464	918	482	863	525	745	601	601	720	619
-CBD	403	867	407	805	411	735	432	614	464	464	555	474
-Back Bay	47	101	57	113	71	127	93	131	137	137	165	142

* "A" columns represent sales in current year dollars.

** "B" columns represent sales in 1977 dollars.

Source: U.S. Census of Retail Trade, Major Retail Centers, 1958-1977. Compiled by the Boston Redevelopment Authority. Back Bay Retail sales for 1958, 1963, and 1967 were estimated by the Boston Redevelopment Authority in 1976.

NOTE: Multipliers used to convert present year dollars to constant year dollars are based on Implicit Price Deflator Series for U.S. GNP from Economic Report of the President, 1980. They are: 1958=2.15, 1963=1.98, 1967=1.790, 1972=1.42, 1977=1.00, and 1979=0.86.



The number of office workers has increased by over fifty percent since 1960; that dramatic gain has fueled much of the retail growth. In addition, affluent residents have moved into housing in neighborhoods downtown, such as Back Bay, Beacon Hill, the South End, and in new housing on the Waterfront. Between 1970 and 1980, the population increased ten percent and real per capita income grew by five percent in these areas.

The growth of captive markets concurrent with the decline of the traditional trade has led to adjustments in Central Boston's retail sector, especially in its dominant retail district — Downtown Crossing. Such adjustments take time however, and the delays in shifting from old to new retail strategies may have contributed to declining sales during the 1975-1976 recession. Though sales have increased since 1977, adjustment of the product mix, marketing techniques, and location of retail activity in Central Boston is ongoing. The adjustment process has varied with each of Central Boston's major shopping areas, as described below.

- Downtown Crossing

Retail trade in Boston traditionally has been concentrated along Washington Street and its vicinity, an area now known as Downtown Crossing. Since well before World War II, the mix of products and merchandising techniques were firmly established to meet the needs of the area's traditional middle-income market. The shift of population

to the suburbs and competition from suburban shopping centers seriously eroded Washington Street's retail sales. Stores which did not adapt their product mix or merchandising techniques to attract new markets, went out of business. In some cases, this area-specific management problem was exacerbated by mismanagement or financial problems chainwide. In others, changes in Boston's retail trade simply reflected national trends: the growing popularity of specialty shops and the increasing dominance of chain stores over independents. Between 1972 and 1979, major department stores or large dry goods stores — Raymond's, Gilchrist's, Stearns, Kennedy's, Conrad Chandler, and R.H. White's — closed their doors, as did many smaller shops.

Recent changes have improved retail sales in the area. In 1978 vehicular traffic was restricted along portions of Washington, Summer, and Winter Streets to form a pedestrian mall. A new name — Downtown Crossing — and such improvements as brick paving, historic-era lights, benches, and an arcade, gave a special identity to the area. As traffic volume decreased and pedestrian volume increased, the air quality and noise levels improved. Several large stores re-oriented their merchandising techniques, and specialty shops moved into some vacant buildings; both attract business from the growing number of downtown employees. Between 1978 and 1980, retail sales for Downtown Crossing grew by twelve percent,⁶ and the benefits

extended to retail business on neighboring streets as well.

Today Downtown Crossing exceeds all other shopping centers in New England in square footage and retail sales.⁷ There is nearly 1.75 million square feet of comparison goods selling space, one million of which is occupied by three general merchandise stores, and the remainder is distributed amongst more than three hundred other stores. In addition, restaurants and personal service-oriented retailers account for nearly a half-million square feet of space. The department stores — two of which are flagship stores of their chains — and major concentrations of jewelry, camera, and apparel stores act as the prime retail attractions. The district is also characterized by predominantly moderately-priced merchandise. Estimated 1982 "consumer-oriented" sales (all categories of retail sales except building materials and automotive items) totaled 450 million dollars, well over two hundred dollars per square foot, and the highest productivity of any major retail shopping district in the region. Nearly half those sales came from purchases by downtown employees.

The potential for sixty percent growth in Downtown Crossing retail sales by 1990 and a strategy for achieving that growth are outlined in "The Downtown Crossing Economic Strategy Plan", a recent study released by the BRA.⁹ Market support exists for an expansion of retail space of up to 400,000 square feet. Some expansion is already underway. Opening in 1984,

Lafayette Place, a large mixed-use project, will house nearly two hundred shops, twenty-four restaurants and cafes, a five hundred-room hotel, and eight hundred parking spaces for shoppers. The complex will add a total of 250,000 square feet of space downtown.

Forecasts for retail growth are based on demographic changes downtown, on the anticipated office employment growth, and on projected increases in the number of tourists and business people visiting the city. The downtown population increased by five percent between 1970 and 1980, and the per capita income of residents grew by eighteen percent.

Trends of smaller household size and a greater number of households in neighborhoods near Downtown Crossing are likely to increase retail sales. The number of employees working downtown is projected to grow by over twenty percent by 1982, the number of business visitors by over forty percent, and the number of tourists by approximately three percent. Projected growth in all three sectors could greatly expand the captive market for Boston's retailers.

Achieving sixty percent growth in retail sales depends on the City and local businesses implementing the planning strategies outlined in "The Downtown Crossing Economic Strategy Plan". The strategies include land use guidelines, traffic and other physical improvements, and long-term management mechanisms.

- Back Bay

Retail sales in Back Bay diverged from trends found elsewhere in Boston between 1948 and 1977. While total retail sales and the numbers of employees and establishments declined city-wide, retail activity in Back Bay increased steadily. Between 1972 and 1977, sales rose four percent and increased by the same percentage between 1977 and 1979.¹⁰ This trend is estimated to have continued with 1982 "consumer-oriented" retail sales estimated at 164 million dollars. In contrast to the Washington Street retail area, Back Bay has had great success in capturing the new captive market and retaining much of its original market.

Unlike Washington Street, which was oriented to the general needs of moderate-income suburban residents and older city dwellers, Back Bay has always maintained its image as a place offering high quality, cosmopolitan merchandise. The shopping environment matched the merchandise, producing a unique ambiance unlike that found in suburban shopping malls. Back Bay's merchandise was better suited to the needs of the growing captive market and the specialized needs of some suburban shoppers, since it included high fashion apparel, art, and restaurants, as opposed to major appliances, furniture, and more traditional apparel. Back Bay had the further advantage of being somewhat more accessible by car than was Washington Street.

The Prudential Center, developed in 1965, substantially increased retailing in the area

with the addition of two major apparel-oriented department stores and a mall of specialty shops. Today Back Bay remains the second largest retail center in Boston with 1.2 million square feet of retail space. When Copley Place is completed, shops in that large mixed-use project will add 300,000 square feet of retail space to the Back Bay shopping district. Neighboring developments, such as the State Transportation Building, will increase the captive market for the area.

- Faneuil Hall Marketplace

Faneuil Hall Marketplace, the newest of Central Boston's retail centers, illustrates the role retail activity can serve in revitalizing underutilized areas of the city. This development established the unique attraction of festival market-type retailing, now seen nationwide.

The complex of specialty shops, novelty shops, restaurants, and small fast food establishments was developed between 1976 and 1978 from historic but decaying warehouses and Faneuil Hall. The environment was designed and is carefully controlled to establish an ambience attractive to tourists. The inclusion of pedestrian malls, scheduled outdoor entertainment, and strict area-wide management were relatively new marketing strategies to Boston and, in only a few years, have helped Faneuil Hall Marketplace to become a strong regional retail and tourist attraction.

Faneuil Hall Marketplace houses 150 shops in 220,000 square feet of retail space.¹¹ 1982 estimated "consumer-

oriented" retail sales amounted to approximately eighty million dollars, well over three hundred dollars per square foot.

Faneuil Hall Marketplace, like Downtown Crossing, should benefit from future growth in downtown employment. Retail sales for the marketplace should also increase from the anticipated growth of tourism in Boston.

- Other Retail Areas

In addition to the three major retail districts, other Central Boston retail clusters — Charles Street, the North End and Haymarket, the Waterfront, Chinatown and the Theater District — have distinct identities and draw customers from beyond the districts' immediate neighborhoods. Comparison, convenience, and service shops, and restaurants are scattered throughout the Financial District, serving the needs of office workers, and in other parts of Central Boston, where they accommodate residents of immediate neighborhoods. The 1982 estimated consumer-oriented retail sales for these areas combined totaled two hundred million dollars.

DEVELOPMENT ISSUES

To capitalize on the potential benefits of retail growth and to help provide safe, convenient, and suitable shopping facilities for residents and visitors, the City will continue to implement existing development strategies and design new ones which could help to accomplish the goals noted below.

Development policies should

aim, first, to increase retail activity in Central Boston. "The Downtown Crossing Economic Strategy Plan" is a step in that direction, providing adequate market information to attract new retail investors. Central Boston has an advantage over regional retail competitors because of its distinctive architectural, historic, and cultural attractions, but those attractions have not been sufficiently marketed to regional shoppers. Better promotion may help to increase retail activity from the regional market, as is demonstrated by the success of Faneuil Hall Marketplace and Back Bay.

A second aim of retail development policy will be to maintain and expand the variety of products and price ranges, as well as the distinctive characteristics of Downtown Crossing, Back Bay, and Faneuil Hall Marketplace. The Back Bay shopping district and Faneuil Hall Marketplace are both retail successes. It is important to ensure that the qualities which give them their special character are preserved. Large scale retail development that would broaden the market appeal and magnitude of these districts to a point at which it would dilute their special character should be discouraged.

Downtown Crossing requires special attention, since it is the one retail district that suffered from a long-term decline. Its enhancement is closely tied to goals for revitalizing adjoining underutilized areas — lower Washington Street and the adult entertainment zone. For these reasons, the implementation of the "Downtown Crossing Economic Strategy Plan" is especially important.

A third aim of retail development policy is to improve the vitality and attractiveness of some shopping districts so they contribute to the physical, as well as economic, improvement of the city. Small-scale changes — landscaping, well-located benches, signage, outdoor cafes — can give a clear identity to an area and make it more habitable. The "Downtown Crossing Economic Strategy Plan" describes small-scale physical improvements that the City and merchants could implement in that part of Central Boston. Copley Square in Back Bay could be a hospitable, lively place for shoppers to relax or view outdoor entertainment, but it is not well-connected with the street, lacks trees and comfortable seating. A process is underway by the BRA to determine what design changes could make the square a more vital open space.

In addition to small-scale changes, substantial retail projects can improve the design of key areas of the city, especially when retail is included in development schemes for other commercial sectors. When planning new development of some magnitude, it is important to locate retail establishments in a way that will reinforce activity along streets.

A fourth aim is to improve the accessibility of retail areas. When shops are safely and easily accessible and provide a variety of goods in a range of prices, the retail sector can effectively meet the needs of shoppers. Some areas are currently perceived as unsafe. Major problems facing Downtown Crossing are the close proximity of the adult entertainment dis-

trict and underutilized areas of lower Washington Street, and the lack of nighttime activity within Downtown Crossing itself.

Accessibility is a key factor in attracting shoppers and in facilitating their activities. It could be improved for all three major districts. Downtown shoppers depend on mass transit, and over sixty-five percent of frequent MBTA riders shop there.¹² However, those who do not use public transit are less likely to shop Downtown (only twenty-six percent of non-riders shop there). To increase ridership and to improve the trip for current riders, an important component of development policy would aim to incorporate new stations within planned development projects and to upgrade existing ones. To attract auto-oriented shoppers, development policy should aim to improve vehicular accessibility without unduly burdening the circulation system and provide safe, convenient parking where it is most needed. Lafayette Place Garage, with approximately eight hundred spaces will be reserved for shoppers, represents an example of this.

Guiding retail growth is important to the city physically, economically, and socially. As evidenced by Faneuil Hall Marketplace and Downtown Crossing, retail improvements can upgrade the appearance and utility of open spaces and streets in commercial districts and can spur area revitalization. Retail growth can draw more business from the regional market, provide additional jobs and tax revenue, and stimulate growth

in other commercial sectors. When shops are easily accessible and provide a variety of goods in a range of prices, the retail sector can help to meet the needs of residents, workers, and visitors.

NOTES

1. Frances Larson and Gregory Perkins, "Retail Trade in Boston: Yesterday, Today, and Tomorrow", Boston Redevelopment Authority, May 1981, p. 2.
2. United States Census of Retail Trade, 1977. This is the latest edition available in 1983.
3. Ibid, p. 1.
4. United States Department of Commerce, "Census of Population and Housing", 1950 and 1970; and "Current Population Reports - Consumer Income", Series P-60, #118, 1979.
5. Skidmore, Owings and Merrill, draft of "Downtown Crossing Economic Strategy Plan", Boston Redevelopment Authority, May 1983, p. 12.
6. Ibid, p. 20.
7. Ibid, p. 2.
8. Ibid.
9. Ibid.
10. Larson and Perkins, p. 34.
11. Ibid.
12. Skidmore, Owings and Merrill, p. 28.

Introduction

Manufacturing in Boston has stabilized since 1975, as evidenced by its current employment level. This signifies a marked improvement over trends that began after World War II. With its current stability, manufacturing continues to perform an important role in Boston. The manufacturing industry provides jobs for ten percent of Boston's labor force, most often in proximity to employees' homes, where the firms also contribute to the health of the neighborhoods. Manufacturing helps to diversify the local economy. Exporting products regionally and nationally, it draws new dollars into the city.

In the past, manufacturing played a more prominent role in the local economy. In 1948, industrial employment accounted for nearly thirty percent of the jobs in Boston; today its share of city-wide employment is ten percent. Despite the former prominence of manufacturing employment, Boston was a center for mercantile trade, and its economy was more diversified than that of many other New England cities. The maintenance of manufacturing has facilitated that on-going diversification.

The composition of Boston's manufacturing sectors has changed as new types of firms have expanded. The city's strongest industries traditionally have been food products, apparel and leather, printing and publishing, fabricated metals, and non-electrical machinery. Though the traditional sectors remain the five largest in Boston, high growth sectors — instruments, electrical equipment, transportation equipment, chemical products, and rubber and plastic products — have assumed more prominence since 1975 than they held in the past. Employment growth in

these sectors, which capitalize upon Boston's medical and educational institutions and their labor force, is projected to continue and to offset slight declines in some of the traditional sectors.¹

Changes in land use and in the industry itself raise development policy issues. As commercial and institutional developers are able to outbid traditional manufacturers for downtown space, some firms which rely on the area's land and labor characteristics are threatened with dislocation. Employees accustomed to working near their homes are threatened with unemployment. New, growing firms often can successfully compete for space, and their location decisions could benefit the city's manufacturing base.

Requisite skills for manufacturing jobs have changed in the past twenty years, due to the decline in traditional sectors, automation, and the growth of high technology firms. Workers skilled in traditional operations may lack training appropriate for employment in the high growth sectors or in the growing service industry. To help workers re-adjust, to improve their employment prospects, and to provide the industry with a well-qualified labor force, appropriate training programs are required.

This chapter provides background information on the changing characteristics — employment levels, types, location, and size — of manufacturing in Boston. It describes the City's current strategies to maintain and strengthen the industrial base, and it outlines issues to consider in formulating development policy for the downtown.

MANUFACTURING TRENDS AND CHARACTERISTICS

• Industry-Wide Employment

The number of manufacturing jobs in Boston has stabilized for the past seven years at approximately 50,000.² The current employment level, though substantially lower than in peak years, signifies a marked improvement over trends that began around World War II. Between 1950 and 1975, the city lost 50,000 jobs, partly through the closure or relocation of firms in New England's traditional manufacturing sectors. Though Boston's loss was part of a region-wide decline, it was exacerbated by naval base closings and a reduction in port activity.

Manufacturing's prominence in the local economy also diminished as employment in the service industry and finance, insurance, and real estate businesses (FIRE) increased. In 1950, manufacturing jobs alone accounted for nineteen percent of private employment; and services and FIRE combined accounted for twenty-six percent. By 1981, manufacturing jobs slipped to nine percent of the total number of private labor force positions, and the share of service and FIRE jobs rose to forty-eight percent.

The city's share of manufacturing employment dropped from thirty-five percent in 1950, to seventeen percent in 1981 within the Boston Standard Metropolitan Statistical Area (SMSA). Traditional industries declined for many reasons. Some closed, some moved to southern states or to less expensive land in the suburbs. Others

remain in Boston, but by employing more efficient technology, they have decreased their workforce. In addition, attracted by the amenities of suburban industrial parks — inexpensive land, modern layouts, and convenient access to highways — new high growth firms located there. The city has captured a relatively small share of the SMSA's fast-growing high-technology market, even though employment levels have increased in Boston.

Now that firms have adjusted their work forces to mesh with new manufacturing technologies, employment has reached a steady state and is projected to increase slightly in the 1980s. Forecasts predict that Boston will gain almost four thousand net new manufacturing jobs by 1990, based on trends in high growth sectors which now com-

prise a large share of the growth in the city's manufacturing base. Manufacturing will continue as a solid component of the local economy.

• Traditional Sector Employment

The top five sectors employed nearly seventy-five percent of the manufacturing work force in 1962. That share dropped to sixty-nine percent by 1981. The decrease stemmed from employment gains in high growth sectors and from major contractions in two traditional sectors: between 1962 and 1981, apparel and food products firms cut their work forces by sixty percent. Compared to a city-wide trend in manufacturing employment showing a forty percent loss between 1962-1981, the other traditional sectors fared better. The largest sector, printing and publishing, reduced its workforce by thirteen percent,

**Table III-1 Manufacturing Employment Growth, 1980-1990
Projections for City of Boston**

Employment	1980	1990	Change	
			Number	Percent
Total Manufacturing	51,861	56,529	+ 4,668	+ 9.0%
Durable Goods	20,615	25,130	+ 4,515	+ 21.9
Non-Durable Goods	31,246	31,399	+ 325	+ .5
Growing Industries				
1. Non-Electrical Machinery	4,221	5,808	+ 1,587	37.6%
2. Fabricated Metals	6,970	8,489	+ 1,519	21.8
3. Instruments	2,364	3,146	+ 782	33.0
4. Electrical Equipment	2,296	2,859	+ 563	24.5
5. Chemicals and Related Products	2,202	2,550	+ 348	15.8
Stable or Declining Industries				
1. Leather Products	1,248	1,010	- 238	- 19.1%
2. Apparel and Accessories	7,636	7,407	- 229	- 0.3
3. Food Products	5,635	5,489	- 146	- 2.6
4. Textile Products	629	579	- 50	- 8.0
5. Furniture and Fixtures	885	838	- 47	- 5.3

Source: Boston Redevelopment Authority, from Bureau of Labor Statistics and Massachusetts Division of Employment Security. See Employment Appendices Table 4.

and non-electrical machinery declined by only four percent. Unlike the others, fabricated metals manufacturers have employed eleven percent more workers than in 1962.

Examining 1962-1981 trends does not fully explain the recovery and stabilization some of the traditional manufacturing sectors have experienced after the 1974-1975 recession. Since 1975, the printing and publishing industry has increased its workforce by two percent, in part because of its ties to Boston's growing service industry. Employment in non-electrical machinery production increased by five percent. Fabricated metals manufacturers increased their labor force by eight percent, according to the Massachusetts Division of Employment Security. Although the apparel sector continued to register some losses, its rate of decline diminished as its most stable segment, women's clothing, assumed a larger share of apparel manufacture. Food products lost significant numbers of workers.

In the 1980s, employment in the printing and publishing in-

dustry is expected to increase moderately, but some of Boston's large, mature sectors — food products, apparel, leather, textiles, and furniture — may have some employment losses. The resource-based manufacturing sectors — lumber and wood; stone, clay, and glass; and primary metals — show little growth potential, but they have never been significant components of the city's manufacturing base.

• High Growth Sector Employment

Since 1975, growth in durable goods manufacture has offset some of the decline in traditional sector employment. Transportation equipment firms added eighteen percent more workers; rubber and plastics producers more than doubled their work force. Electrical and electronics grew by thirteen percent. Instrument manufacturing firms increased employment by seventy-eight percent, and chemicals by over fifty percent.

Growth is expected to continue in some sectors. Durable goods production should grow

fastest, particularly in the manufacture of electrical equipment, instruments, non-electrical machinery, and transportation equipment. This trend reflects national and regional growth in the manufacture of high-technology goods. Rubber and plastics, petroleum, chemicals, and other synthetic goods production show positive growth trends. Though these sectors constitute only a small part of Boston's manufacturing base, their growth will increase employment opportunities.

• Size of Manufacturing Firms

Most manufacturing firms in the city are small, according to a 1983 study by the Economic Development and Industrial Corporation (EDIC/Boston).² Over eighty percent employ fewer than fifty workers; about forty percent employ fewer than ten. The predominance of small firms in Boston should help to maintain the city's neighborhood economic base. Despite the predominance of small firms, medium-sized and large firms have a greater impact on em-

Table III-2 Employment Trends in Major Industries in Boston 1975-1981

	1975 Employment	All Mfg.	1981 Employment	All Mfg.	Change
Food Products	7,021	14.0%	5,075	10.0%	- 27.7%
Apparel	8,290	16.0	7,555	15.0	- 8.9
Printing & Publishing	11,573	23.2	11,818	23.3	+ 2.1
Fabricated Metals	6,215	12.4	6,702	13.2	+ 7.8
Non-Electrical Machinery	3,740	7.5	3,920	7.7	+ 4.8
Electrical Equipment	1,883	3.8	2,133	4.2	+13.3
Transportation Equipment	656	1.3	776	1.5	+18.3
Instrument Products	1,292	2.6	2,301	4.5	+78.1
All Manufacturing	49,881	100.0	50,823	100.0	+ 1.9
All Wage & Salary Employment	379,433		422,096		
All Mfg. as % of Wage & Salary		13%		12%	

Source: Massachusetts Division of Employment Security.

ployment levels. Medium-sized firms, employing fifty to one hundred workers, constitute eleven percent of the firms and generate fifteen percent of the manufacturing jobs in Boston. Firms with over one hundred employees account for sixty percent of the manufacturing jobs. In contrast, small firms, those employing less than fifty workers, provide only one-quarter of the jobs. Larger firms, while small in number, dominate the employment in Boston's five traditional industries, as well as in chemicals, primary metals, electrical equipment, and instruments. Expansions and contractions of these large firms are major factors in the health of Boston's manufacturing base.

- Longevity of Manufacturing Operations

New firms play a small role in industrial growth, as 950 established manufacturers accounted for eighty-six percent of the 51,000 manufacturing jobs in Boston in 1981. In contrast, thirty new firms generated nearly one thousand jobs. Firms which left the city or ceased

operations had a greater impact on net employment. Between 1977 and 1981, seventy companies which employed a total of 2,400 workers moved from Boston. Another 189 companies ceased operations, representing a loss of 4,170 jobs.

- Location of Manufacturers

Over half of Boston's manufacturers and over half its manufacturing jobs are concentrated in Central Boston, the vast majority of them Downtown and in the industrial section of South Boston. This section, Fort Point Channel, is contained within the study area boundaries and includes most of the industrially-zoned land in South Boston. Ten percent of the city's manufacturing firms and jobs are located in Back Bay/Fenway/South End, and the remainder are found elsewhere in Boston, but particularly in Roxbury. Downtown accommodates twenty-four percent of the city's manufacturing firms and twenty percent of the jobs. The apparel, printing and publishing, instrument products, and food industries account for eighty percent of these jobs, and, with

a few exceptions, the firms tend to be small.

Downtown, firms tend to cluster in lower rent areas, such as Chinatown and the Leather District. Remaining there is of particular importance to some of them. Printers and publishers choose to be near major customers. Apparel manufacturers rely on their proximity to workers from Chinatown; forty-four percent of the garment workers are employed there. In addition to firms from the traditional sector, some high-growth manufacturers are located Downtown. Approximately eight-two percent of instruments sector employees work there.

Downtown is losing its prominence as a manufacturing location, although development strategies can help to maintain a solid base of industry there. Faced with competition for space from commercial and institutional developers, some firms may close or migrate. The plight of Chinatown's garment industry is illustrative.³ Approximately 185 apparel manufacturers are located in Chinatown, and traditionally they have drawn their work force from residents in the area. Institutional expansion

Table III-3 Manufacturing Establishments by Employment Size Class In Boston 1977-1981

Employment Size Class	Establishments				Employment			
	1977		1981		1977		1981	
1-9	442	39%	360	32%	2,385	4%	1,978	4%
10-19	253	22	285	26	3,521	7	3,686	7
20-49	251	22	241	22	7,623	14	7,199	14
50-99	108	9	120	11	7,301	14	7,952	15
100-149	135	3	46	4	5,239	10	6,321	12
150-249	24	2	21	2	5,037	10	4,197	8
250 +	33	3	32	3	21,423	41	20,887	40
TOTAL	1,146	100%	1,105	100%	53,530	100%	52,220	100%

Source: Boston Manufacturing Universe, EDIC/Boston.

caused thirty-five firms, employing two thousand workers, to seek relocation assistance from Boston's Economic Development and Industrial Corporation (EDIC/Boston). The agency has helped those firms with immediate needs for space to relocate within the city, and EDIC is now developing alternative industrial space for the garment companies and other manufacturers, by renovating the underutilized Boston Army Base located in South Boston, near Chinatown. When redeveloped, the former Army Base will provide 1.4 million square feet of net leasable space to any industry in the city under pressure to relocate because of rising rents or expansion needs. Companies now located around Fort Point Channel and North Station and which are jeopardized by downtown development, should find the Base a suitable facility in which to relocate.

South Boston houses twenty-six percent of Boston's manufacturing firms, primarily in the Fort Point Channel area. With 10,827 jobs, South Boston firms employ the largest percentage (twenty-one percent) of manufacturing workers in the city. Some firms in South Boston are similar to those found Downtown: printing and publishing firms in this area employ nineteen percent of the industry's workers, apparel firms employ fifteen percent, and electrical equipment companies employ twenty-eight percent. South Boston dominates in the number of workers employed in fabricated metals manufacture, with sixty-nine percent of that industry's work force. Firms located here are large, with four of them accounting for most of the area's nearly eleven thousand jobs. The remaining firms employ less than 150 workers.⁴

The Back Bay/Fenway/South End area has ten percent of the city's manufacturing jobs, most of which are in printing and publishing, and chemicals (eighty-four percent in 1981). While nearly thirty percent of Boston's printing and publishing jobs are located in these areas, some printers and publishers have moved to South Boston. Three large firms account for fifty-nine percent of the jobs that remain.

Some manufacturing firms are located elsewhere within the study area's boundaries. Food products firms are found in Charlestown. Transportation equipment firms are concentrated in East Boston, as are some apparel and jewelry/silver plateware manufacturers.

DEVELOPMENT ISSUES

To maintain its existing industrial base and foster the expansion of growing sectors, the

Table III-4 Manufacturing Employment and Establishments in Boston by Neighborhood with Percentage of Total Boston Employment

	1977				1979				1981			
	Estab.		Employ.		Estab.		Employ.		Estab.		Employ.	
Central Boston	306	27%	9,517	18%	283	26%	9,657	19%	269	24%	10,626	20%
South Boston	251	22	10,916	21	256	23	11,364	22	260	24	10,827	21
Allston/ Brighton	71	6	4,356	8	67	6	4,398	8	75	7	4,574	9
Charlestown	32	3	3,515	7	33	3	3,333	6	28	3	2,980	6
East Boston	43	4	2,086	4	48	4	2,743	5	38	3	2,389	4
Back Bay, Fenway, South End	117	10	6,087	12	103	9	5,072	10	111	10	5,470	10
Roxbury	143	12	5,723	11	141	13	5,449	11	153	14	5,638	11
Dorchester/ Mattapan	94	8	6,534	12	88	8	5,930	12	83	7	5,928	11
Jamaica Plain/ Roslindale/ West Roxbury	53	5	1,649	3	53	5	1,352	3	48	4	1,382	3
Hyde Park	36	3	2,146	4	36	3	2,112	4	40	4	2,406	5
TOTAL	1,146	100%	52,527	100%	1,108	100%	51,410	100%	1,105	100%	52,220	100%

Source: Boston Manufacturing Universe, EDIC/Boston.

City needs to continue addressing several important issues. One major issue facing manufacturing firms is the possibility of displacement from commercial and institutional expansion. While some high technology firms can afford to compete for prime locations, many of Boston's traditional industries may have to relocate. Chinatown's garment companies are currently experiencing such pressures, and firms in other areas will experience similar pressures. Commercial development along Fort Point Channel, construction of a Federal office building at North Station, redevelopment in the South End and at South Station will all remove varying amounts of manufacturing space.

EDIC/Boston has implemented several strategies to address this issue. They include developing attractive space in alternative locations, instituting marketing programs, and providing financial assistance and real estate listings to firms needing help. One of the most important facets of the City's industrial policy has been to develop areas of Boston which offer relocation and expansion opportunities. The development of Boston Army Base and Boston Marine Industrial Park has significantly increased the prospects for retaining manufacturing firms as part of the City's economic base. In order to encourage commercial expansion without jeopardizing the future of manufacturing, other likely sites in the city for industrial activity should be promoted. Opportunities currently available include the industrially-zoned area of South Boston, the Army Base, and

Roxbury.

Zoning is one of the City's mechanisms for guiding development. In maintaining industrially-zoned areas of Central Boston in the face of pressures from the development of other uses, the City has affirmed its commitment to its manufacturing sector. As development proposals are reviewed in the future, that commitment should be maintained. The City will continue to assist in retention and relocation efforts, looking for solutions in a city-wide context.

Equally as important as locations and levels of employment are the types of jobs created and kinds of skill required by the changing industry. Skills required for manufacturing jobs have changed as employment in traditional sectors has declined. Modernization within traditional sectors, and growth in high technology sectors and in the service industries require different sets of skills. To adjust, workers require training. Budget cuts in publicly-supported training programs have curtailed some re-education efforts. But Boston, in cooperation with the Private Industry Council, has instituted new training programs. EDIC's Boston Technical Center offers industrial training programs tailored to needs of specific companies. Additional efforts to help with skills readjustment should be considered part of the City's development strategy.

As development takes place in Central Boston, the city will continue its efforts to maintain its industrial base, to develop suitable locations for manufacturing, and to improve employment prospects for residents.

NOTES

1. See "City of Boston Employment Projections", Employment Appendices.
2. John Accordino with Robert Pritchard, draft report, "Boston Manufacturing Universe", Economic Development and Industrial Corporation of Boston, 1983. Unless otherwise noted, manufacturing data from this source provides the information contained in this chapter.
3. For additional information, see "The Garment Industry: Will It Survive in Boston?", EDIC/Boston, June 1981.
4. Accordino, p. 20.

Introduction

Boston's visitor-related sectors — its convention, tourist, and hotel industries — are major components of the city's economy and contribute to local employment and property tax revenue. Growth in each of these sectors is sensitive to the city's overall economic stability because of the inter-relationships of all the commercial sectors. The growth in office space and retail activity, for example, depends partially on the availability of hotel rooms to serve the business visitor and the presence of tourists to purchase goods in Boston's stores.

While the health of the visitor-related sectors is closely linked to that of Boston's office, retail, and institutional sectors, it also relies on the success of the visitor-related sectors themselves. The convention market, for instance, can only expand to the limits of the supply of hotel rooms. Likewise, without sufficient convention facilities, hotel occupancy rates decline.

Given the symbiotic relationship among the commercial sectors and within the visitor-related sectors themselves, this section focuses on how those inter-relationships will affect the 1982 hotel market. It describes the current status of convention and gate show facilities, tourist attractions, and the hotel market. This section also includes projections for future growth for each sector and outlines what actions may affect that growth. Some actions are directly related to development policy: the need to expand the Hynes Auditorium, the need for aggressive marketing of visitor-related facilities, and the need to ensure a price range for hotel rooms that would encourage tourists, business visitors and conventioners, to visit Boston.

CONVENTIONS AND GATESHOWS

Boston's success in attracting national and regional meetings depends primarily on the availability and quality of its gate show, convention, and hotel facilities. Although facilities for conventions and gate shows sometimes serve overlapping markets, generally each provides for distinct spatial needs. In addition to exhibition space, conventions require more meeting rooms and auditoriums than do gate shows, which need exhibition space primarily. Now and for the next few years, the city is better equipped to draw gate shows. Inadequate convention facilities and the limited price range for accommodations hamper efforts to expand the convention market here. As a result, the City and the Commonwealth are losing potential increases in business and tax revenues. (Two types of convention markets exist: one is those groups needing large spaces which only convention centers provide; the other is smaller groups whose spatial needs are met by hotel facilities. This report focuses on the first market.)

Currently there are two major gate show and convention facilities in the city. Hynes Auditorium, a publicly-owned convention center, offers meeting, exhibition, and auditorium space. The Hynes can accommodate gate shows, but because these regional attractions generate high volumes of traffic, congesting streets in adjacent

neighborhoods, the Hynes limits its gate shows to twenty-two annually. Bayside Exposition Center, a new privately-owned gate show facility, has more exhibition space than the Hynes and is better sited for handling traffic. It has minimal facilities for meetings and large assemblies. Occasionally, other large facilities, such as Boston Garden, provide space for gate shows.

A third major facility, Boscom, will be opening soon. Massport has leased Commonwealth Pier, formerly a gate show facility, to a private developer to create a high-technology trade mart. Reconstruction of the pier will provide 785,000 square feet of exhibit sales space, of which 500,000 square feet will be allocated for permanent showrooms and 55,000 square feet for meetings. Although Boscom will serve primarily as a center for marketing high-technology products to trade representatives, 150,000 square feet will be available for general trade, gate shows, or conventions.

Hynes and Bayside now compete with four other facilities in the New England region: the Northeast Trade Center (a privately-operated gate show facility in Woburn); and the Springfield, Worcester, and Hartford Civic Centers. The civic centers provide arena and/or large auditorium space, as well as rooms for exhibits and meetings. The regional facilities are all equipped for holding gate shows and small conventions.

Trade shows, in particular, book space at the Northeast Trade Center, and gate shows

use the Bayside Exposition Center. However, because both these private facilities are more expensive than public ones, many groups prefer to use regional public facilities in Worcester, Springfield, Hartford, or Boston.

The Worcester and Hartford Civic Centers, similar in size, attract some former patrons of the Hynes Auditorium. However, size limitations and lack of hotel rooms restrict the ability of some regional facilities to compete with those in Boston, as well as their ability to attract much new business to New England.

Outside of New England, major competitors for Boston include seven East Coast convention centers located in New York; Atlantic City; Philadelphia; Atlanta; Washington, D.C.; Baltimore; and Miami. All these facilities have large exhibit halls and are well supplied with meeting and hotel rooms. In comparison, the Hynes Auditorium is a small facility.

The Hynes Auditorium attracts approximately thirty conventions per year, a capture rate of five percent of the national market. Currently, few cities are able to draw more than fifty conventions annually. However, the national convention market is expected to grow by nearly two percent annually.¹ It is estimated that eighty percent of future convention groups will be similar in size to those now booking the Hynes; twenty percent will be larger. Depending on plans to expand the Hynes, Boston could attract nearly ten percent of the market (approximately sixty groups) by 1990.

In 1981, the City of Boston, which then owned and operated the Hynes Auditorium, commissioned a study² to examine the feasibility of expanding the Auditorium and subsequently commissioned other studies to generate space programming³ and a design concept for the expansion.⁴ From the studies, which were financially supported by the Commonwealth, it was determined that the Hynes site could support an additional 210,000 gross square feet of exhibition space, 72,000 gross square feet of meeting rooms and 36,000 gross square feet of conference/exhibition space. Also, if the Hynes were expanded and if five thousand additional hotel rooms were built, the city could attract twice as many conventions annually as it currently draws.

Near the completion of the preliminary design process, the Commonwealth purchased the Auditorium and established the Massachusetts Convention Center Authority, which is now reviewing the City's plans for the Hynes.

TOURISM

Between 1970 and 1983, tourism in Boston grew at an

annual rate of 4.8 percent, and in 1982, 5,100,000 tourists visited the city. Tourism is expected to grow by 3.3 percent annually and according to this projection, 7,066,000 tourists will visit Boston in 1992.

Past and projected growth stems, in part, from revitalization efforts in Boston. Prior to the United States' Bicentennial celebration, many of the city's more than three hundred historic and cultural attractions were improved and remain in good condition today. The redevelopment of Faneuil Hall into a marketplace, improvements to Downtown Crossing, and the continued growth of retail in Back Bay increased the attractiveness of shopping in the city. Projects recently completed or under construction, such as the State Transportation Building and its retail component, Cityplace, and the Four Seasons hotel and condominium complex will help revitalize the Theater District. Renovations to several theaters — the Shubert and the Wang Center for the Performing Arts, formerly the Metropolitan Center, (both completed), and the Saxon (planned) — will improve both the quality of performance facilities and the image of the district.

Massachusetts receives 2.3 percent of the national tourism, and Boston draws nearly one-quarter of that business.⁵ However, the growth of tourism depends on several factors. First, tourism is sensitive to the national economy. As a consequence of the national economic recession, in Boston attendance counts at major attractions have not risen in the past few years. However, tourism is projected to grow with the economic recovery. Nationally tourism is expected to increase by six percent annually in the 1980s; an increase in the number of foreign travelers visiting the U.S. may constitute part of that growth.

A second factor which affects the growth of tourism is the availability of moderately priced hotel rooms. Boston's supply of such rooms is limited, as is the prospective construction of rooms in the moderate price range. This is likely to dampen the potential growth of tourism in the city from the six percent expected nationwide, to 3.3 percent annually to 1992.

HOTELS

For several decades, there was little hotel construction in Boston, but in recent years that trend has changed. During 1981 and 1982, four new hotels and one addition were completed, increasing the city's stock of hotel rooms by 1,332. By late 1982, the construction of four more hotels (a total of 2,743 rooms) was underway. When construction is completed, the additional hotels will increase the number of rooms in Boston to over eleven thousand by the end of 1985. (This factor in-

Table IV-1 Hotel Room Supply Summary

	Number	Change		Annual Rate
		Number	Percent	
1978	6,925			
1982	8,257	1,332	+ 19%	4.5%
1985	11,000*	2,743	+ 33%	10.0
1992 Projected	14,945**	3,945	+ 36%	4.5

* Includes existing rooms and those underway or scheduled for completion by 1985.

** Assumes refurbishing of 2,250 obsolescent hotel rooms and construction of 3,945 new rooms.

Sources: See Table IV-3.

Boston Redevelopment Authority, Development Appendices Table 2.

Table IV-2 1982 Hotel Stock In Downtown Boston by Class and Major Use

	Class A Rooms	Percent	Class B Rooms	Percent	Class C Rooms	Percent	Total
Business Visitor	2,554	65%	1,159	29%	221	6%	3,334
Tourist	643	39	707	43	296	18	1,646
Convention	1,412	60	828	35	105	5	2,345
TOTAL	4,609	58	2,694	34	622	8	7,925

Source: Boston Redevelopment Authority.

1982 Downtown Hotel Room Sales By Purpose of Overnight Stay

	Percent	Total Room Sales
Business Visitor	48	1,065,600
Tourist	21	458,740
Convention	31	648,850
TOTAL	100%	2,209,190

Source: Boston Redevelopment Authority Hotel Survey.

cludes the loss of one hundred units in the Hotel Essex conversion.)

This development reflects expectations of continued growth of the local economy, an increase in tourism, and the expansion of the city's convention facilities. But it may also pose some problems, if the supply of rooms exceeds the demand.

Hotels in downtown Boston contained 7,925 rooms in the first quarter of 1983. Over one-half of the rooms (sixty percent) were classified as luxury (Class A); one-third were moderately priced (Class B); the remainder (seven percent) were inexpensive (Class C). Fifty percent of the guests were business visitors, a group which accounts for much of the demand for luxury accommodations. Thirty percent of the hotel guests were conventioners, and only twenty percent were tourists.

A comparison of Boston's hotel stock with that of other major East Coast cities indicates that Boston's mix of rooms departs from proportions found

elsewhere. Boston has the smallest share of inexpensive rooms. As well, the city has a greater proportion of expensive rooms than is found in all other major East Coast cities except Miami.

• Future Hotel Market

A range of factors influence the future hotel market. Many of them, such as fluctuations in the national economy, are beyond the City's control. Other factors, such as the provision and promotion of convention facilities; the development of office space; and the location, timing, and type of hotel construction are affected by the actions of the City and the Commonwealth. Depending on the future conditions of these factors, the outlook for Boston's hotel market in the coming decade is excellent, as projections based on business, tourist, and convention related demand, described below, indicate.

However, a number of uncertainties could constrain the actual performance. First, office

employment could grow at a lower rate than projected. Second, fewer State and City funds are allocated to tourism and convention promotion in Boston than in other large East Coast cities; the 1983 decline in the number of convention delegates in Boston is partially attributable to inadequate promotion. Insufficient marketing in the coming decade could limit the growth of tourism and conventions. Finally, the Massachusetts' Convention Center Authority has yet to decide on the future of the Hynes Auditorium expansion. The attendant uncertainty and delays in expanding Boston's convention facilities could have a significant effect on the city's future hotel market. With Boston's extraordinary rate of hotel room construction, shortfalls in marketing in 1983, and the prospect for delays in the expansion of the Hynes Auditorium have created some concern about the outlook for an orderly market for Boston's hotel industry over the next several years. A description

Table IV-3 Business Hotel Room Demand

	1978	1982	1992 Projected	Change 1982-1992 Number	Percent	Annual Rate of Change 1978-82	1982-92
Downtown Employment	280,000	297,000	362,000	+ 65,000	+ 22%	1.5%	2.0%
Hotel Room Demand	3,393	4,135	6,942	+ 2,807	+ 68	5.1	5.3
Hotel Rooms Per Employee	3.41	3.48	4.9	+ 1.42	+ 41	0.5	3.5

Sources: Boston Redevelopment Authority, "Boston's Projected Employment in the 1980's: Services, Information and High Technology Industries Lead a Resurgence of Job Opportunities," January 1983.

Boston Redevelopment Authority, *Hotel and Convention Center Demand and Supply in Boston, Past, Present, and Future*, March 1979.

Greater Boston Convention and Tourist Bureau, *Time for Action, 1983 Annual Report*, April 1983. Boston Redevelopment Authority, "A Development Strategy for Central Boston," Draft Report, May 1983.

of the consequences of inadequate marketing and delayed expansion of the Hynes on Boston's hotel market follows the projections for substantial growth.

- Business-Related Demand

During the next decade, downtown employment is projected to grow at an annual rate of nearly two percent, rising from 289,700 jobs in 1982, to 342,000 jobs by 1992, in line with national, regional, and local projections for job growth in business and professional services, finance and communications, and the high-technology industry. To generate business-related demand for hotel rooms, the employment projections were used in conjunction with a ratio of rooms demanded per employee⁶. The ratio used in projecting demand between 1982

and 1992 is 4.9 rooms per employee, yielding a forty-one percent increase in demand between 1982 and 1992.

- Tourist-Related Demand

The supply of moderately priced rooms in the city is inadequate for meeting the present demands of tourism, so tourists often stay in hotels elsewhere in the metropolitan area. In the communities adjacent to Boston, there are over twenty-eight hundred hotel rooms, and the majority of them are moderately priced. Because of the lack of moderately priced rooms, the rate of growth forecast for Boston (3.3 percent annual growth to 1992) is less than the six percent growth rate projected nationally.

- Convention-Related Demand

The future demand for hotel rooms generated by conven-

tioners depends on the development of a new or expanded convention center.⁵ If the Hynes Auditorium is expanded, Boston could double the present number of conventions held there.

If convention facilities are not expanded, the hotel business will suffer from an excess of rooms. Even if plans are finalized, lengthy delays in expanding the Hynes Auditorium, while other East Coast facilities are being developed, will limit Boston's ability to attract a large share of the national market for many years, since conventions are typically booked five years in advance.

The overall demand for hotel rooms would increase by eighty-four percent in the next decade under the conditions projected above. The composition of demand would change as the convention market increases.

Table IV-4 Tourist Hotel Room Demand

	1978	1982	1992 Projected	Change 1982-1992 Number	Percent	Annual Rate of Change 1978-82	1982-92
Tourists	5,100,000	5,100,000	7,066,600	1,966,600	+ 38.6%	0%	3.3%
Hotel Room Demand	1,413	1,677	3,153	+ 1,476	+ 88	4.4	6.5
Capture Rate	7.8%	8.2%	11.4%	+ 3.2%	+ 39.0	1.3	3.3

Sources: See Table IV-3.

Table IV-5 Convention Market Hotel Room Demand

	1978	1982	1992 Projected	Change 1982-1992		Annual Rate of Change	
				Number	Percent	1978-82	1982-92
Convention Delegates	269,000	362,000	730,000	+368,000	+102%	7.7%	7.3%
Hotel Room Demand	2,119	2,445	5,135	+2,690	+110	3.6	7.7
Average Length of Stay (Days)	2.2	1.8	1.8	-	-		

Sources: See Table IV-3.

Peat, Marwick, Mitchell & Co., *A Report on Boston's Convention Market and the Expansion of Hynes Auditorium*, September 1981.

Boston Redevelopment Authority, *A New Convention Center for Boston; Rebuilding the John B. Hynes Veterans Auditorium*, October 1982.

Table IV-6 Hotel Room Demand Summary

	1978	1982	1992 Projected	Change 1982-1992		Annual Rate of Change	
				Number	Percent	1978-82	1982-92
(Number of Rooms)							
Business	3,393	4,135	6,942	+2,807	+68%	5.1%	5.3%
Tourist	1,413	1,677	3,153	+1,476	+88	4.4	6.5
Convention	2,119	2,445	5,135	+2,690	+110	3.6	7.7
TOTAL	6,925	8,257	15,230	+6,973	+84%	4.5	6.3
(Percent Distribution)							
Business	49%	50%	45%	40%			
Tourist	20	20	21	21			
Convention	31	30	34	39			
TOTAL	100%	100%	100%	100%			

Sources: See Tables IV-1, IV-3, IV-4 and IV-5.

As noted previously, achieving the hotel growth forecasted above is contingent upon marketing the city's visitor-related facilities and on the timing of the Hynes expansion. Should these prospects not materialize as expected, there is likely to be

an oversupply of hotel rooms, given the substantial new construction recently. Counting rooms recently completed and under construction, Boston's inventory will have increased by four thousand rooms by the beginning of 1985 — growing

from 6,925 rooms in 1978 to 11,093.

Though 1982-1992 demand is projected to grow at an annual rate of 6.3 percent, there is some concern about the prospects of the hotel industry in an interim period, 1983 to 1988. In 1983, the number of conventioners will decline from that of previous year; this is attributed to inadequate marketing resources. The Greater Boston Convention and Tourist Bureau projects hotel occupancy rates to decline substantially in 1985, if marketing is not improved. If additional hotel rooms are constructed by 1988 in the absence of expanded convention facilities, the potential decline would be severe.

Table IV-7 Comparison of Projected Demand and Supply of Hotel Rooms

	Demand	Supply	Occupancy Rate
1978		6,925	77.0%
1982		8,257	68.4
1985 Scheduled		10,996	64.4*
			48.6**
1992 Projected	15,230	14,945	70.0

* With marketing.

** Without marketing.

Source: Boston Redevelopment Authority. Marketing projections from the Greater Boston Convention and Tourist Bureau.

The development of fourteen hundred rooms between 1988 and 1992 would meet the demand projected in optimal circumstances (i.e., with the Hynes expansion, more promotional activity, and increases in the supply of moderately priced accommodations).

A 1981 survey of hotel operators, and a summary of hotel projects scheduled for 1985 completion and of those proposed for construction by 1992, give an indication of the composition of the future supply of hotel rooms in Central Boston.

According to the survey, most hotel operators aim to capture the top of Boston's market, the business traveler. This market commands the most expensive rooms and is also the most stable hotel business in the city. Because tourist demand is considered a lower-priced and weekend market, no hotels have been planned primarily for that market.

A review of the projected 1985 supply indicates that nearly all of the hotels are intended

for the Class A market. The only inexpensive rooms which might be generated, would result inadvertently from new construction. Some existing Class A and B hotels might be forced to lower their rates to remain competitive, thus filling the market for less expensive accommodations.

In 1978, prior to the boom in hotel construction in the 1980s, the hotel occupancy rate was seventy-seven percent and exceeded the generally acceptable occupancy level of seventy percent. (This rate ensures an adequate supply for times of peak demand.) As new hotels opened, the occupancy rate dropped to 68.4 percent in 1982. Because the timing of the Hynes Auditorium expansion has been delayed, hotels now under construction, which were planned in anticipation of increased demand from conventioners, will not receive the business once expected by 1985. 1985 occupancy rates are projected to be 64.6 percent with marketing, and only 48.6 per-

cent without marketing. Assuming the Hynes will be expanded, by 1992 the occupancy rate could rise to the acceptable level of seventy percent.

SALES, EMPLOYMENT, AND TAX REVENUE

Revenues from visitor-related industries are generated in three ways. The most substantial revenue comes from direct and indirect sales in retail, restaurant, and hotel trade, as well as transportation. Personal income of the twenty-eight thousand people employed at visitor-related facilities accounts for the second largest source of revenue. City and State tax receipts are the third source.

Of the three industries, tourism accounts for forty-four percent of the total revenue generated, business and conventions for twenty-two percent. Tourists, although accounting for the lowest hotel room requirement of the three sectors, generate more employment and tax revenue than either business

Table IV-8 Potential for an Oversupply of Hotel Rooms in Boston

	Demand		Supply		Occupancy Rate	Potential for Oversupply (Calculated at 70% Occupancy)
	Total	Convention-Related	Total	Annual Rate of Change Over Preceding Period		
1982	8,125	2,445	8,257		68.4%	132
1985 Projected	10,402 ^a	3,121 ^a	10,996	10.2%	64.6 ^a	594 ^a
	8,643 ^b	2,593 ^b			48.6 ^b	2,353 ^b
1988 Projected	13,545 ^c	4,605 ^c	13,545	7.2	70.0	
	12,855 ^d	3,915 ^d			66.4 ^c	690 ^c
	12,140 ^e	3,200 ^e			62.7 ^d	1,405 ^d
1992 Projected	15,230	5,135	14,945	2.5	70.0	-

a With marketing.

b Without marketing.

c Convention-related hotel room demand with Hynes expansion.

d Convention-related hotel room demand with delay in Hynes.

e Convention demand with delay in Hynes and problems in coordinating the use of other facilities to suit convention needs.

Source: Boston Redevelopment Authority.

or convention visitors.

Although salaries generated by visitor-related employment constitute a significant share of revenues, the salaries are generally not high. Jobs created by hotel, tourist, and convention industries are found within the industries themselves and in related services, such as restaurants, retail stores, and transportation facilities. The six thousand people employed in Boston's hotels work at low-skilled (sixty-six percent) and medium-skilled (twenty percent) jobs. Jobs and salaries created in related services are at levels comparable to those in the hotel industry.

In revenues derived by the public sector, the Commonwealth benefits more from visitor-related businesses than the City does, under the current tax structure. The Commonwealth taxes the sales of liquor, meals, and hotel rooms, as well as corporate and personal income. The City receives only the property tax benefits from the hotels and related commercial enterprises (with a small percentage of the State-collected sales tax returning to the City in the form of local aid). As a result, the City profits less from the development of hotels and tourist and convention facilities than does the State.

DEVELOPMENT ISSUES

Despite the promising projections for the growth of Boston's visitor-related sectors, several issues related to future development require resolution.

First, achieving the growth projected in this report depends on the timing of the Hynes

Auditorium expansion. Because convention groups book space years in advance, the uncertainty surrounding the expansion may adversely affect the hotel business and diminish State and, to a lesser extent, City revenues.

Second, the projections emphasize the need for marketing visitor-related facilities. In 1985, according to the Greater Boston Convention and Tourist Bureau, a successful marketing program could make a sixteen percent difference in the hotel room occupancy rate, thus recouping some of the loss attributed to the delayed expansion of convention facilities.

Third, the range of prices for hotel rooms is likely to become imbalanced. In 1983, the price range distribution of rooms was sixty-one percent Class A, thirty percent Class B, and nine percent Class C. The hotel supply projected for 1985 completion and that planned for 1992 would add a disproportionate number of Class A rooms. An optimal range would approximate the 1983 mix, perhaps with a slightly greater proportion of Class B rooms. This would serve two purposes. It would encourage overnight visits by tourists, who generate more local revenue than do business visitors and conventioners, and it would make Boston more affordable for all visitors.

Resolving the development issues will require the continued coordination of the City's and the Commonwealth's efforts, as well as the cooperation of businesses within each of the visitor-related sectors.

NOTES

1. Peat, Marwick, Mitchell and Company, "A

Report on Boston's Convention Market and the Expansion of Hynes Auditorium", Boston Redevelopment Authority and Boston Public Facilities Department, September 1981.

2. Ibid.
3. Perez Associates, "Hynes Auditorium Expansion Space Program Report", Volume 1, Boston Redevelopment Authority, 1981.
4. Kallman, McKinnell and Wood, "Hynes Auditorium Expansion Architectural and Engineering Summary", Volume 1, Boston Redevelopment Authority, 1981.
5. Boston Redevelopment Authority, "Hotel and Convention Center Demand and Supply in Boston, Past, Present and Future", March 1979, p. VI-3.
6. Currently, it is estimated that each Downtown employee creates an annual demand for 3.48 rooms, but it is assumed that the ratio will increase. Office-related businesses, whose employment is increasing, generate more demand for hotel rooms than do other types of commercial activity.

Introduction

Boston's image nationally and globally is closely tied to its pre-eminence in education and medicine. In turn, these fields have had a positive effect on the local economy and produced jobs for Boston residents. Institutions have also helped to expand the economy of the Boston metropolitan area and have been integral to the regional growth in high technology and biomedicine. This latter field is expected to become a major growth sector in the 1980s and 1990s in Boston. In recent years, the expanding needs of medical and educational institutions have generated a number of major development projects.

Not all of this growth, however, has been beneficial to the city. In addition to removing property from the tax rolls, some expansion has displaced long-term residents. Where institutional development has not been coordinated and/or planned with the City and its neighborhoods, opportunities to improve existing conditions have diminished.

This section focuses on Boston's educational and medical institutions, describing their growth over the last twenty years, projecting trends for this decade, and discussing issues generated by new institutional development. Cultural institutions are described in the visitor-related facilities section of this report.

INSTITUTIONAL CHARACTERISTICS

Medical and educational institutions are major employers in Boston; over ten percent of employees in the city work in colleges and medical facilities. Amongst the largest employers are Boston University, Northeastern University, Massachusetts General Hospital (MGH), Tufts Medical Schools, New England Medical Center (NEMC), and Brigham and Women's Hospital (BWH). Boston University alone employs over five thousand faculty and staff, as well as providing part-time employment to approximately six thousand students. Nearly sixty-five percent of city-wide employment in the two fields is located in Central Boston.

The physical expansion and renovation which has accompanied employment growth in certain institutions has been impressive. Between 1975 and 1982, medical institutions in Central Boston added nearly three million square feet with an accompanying employment growth of thirty-four percent. In the Longwood Medical Area, Beth Israel Hospital constructed a new in-patient facility in 1976 and has recently expanded it; Forber Cancer Institute added 400,000 square feet in 1978. Brigham and Women's Hospital built a new center and laboratory as it consolidated facilities in 1980.

A shared materials handling center, Servicenter, was built in the Longwood Medical Area in the same year. The Medical Area Total Energy Plant, another facility used jointly by the area's institutions, was com-

pleted in 1982. Medical institutions around North Station have also completed development projects since 1975. Massachusetts Eye and Ear Infirmary expanded around the Charles Street Jail in 1976; Massachusetts General Hospital added an ambulatory care center in 1981; and Massachusetts Rehabilitation Hospital constructed an addition. In Chinatown, Tufts Medical Schools grew with the addition of the Nutrition Center in 1982; the New England Medical Center's Pediatric Hospital was completed in the same year.

Educational institutions city-wide added 1,830,000 square feet between 1975 and 1983, despite a lack of employment growth. Some of that expansion, as well as rehabilitation, took place in Central Boston. Bunker Hill Community College built a new campus in 1978; Northeastern University increased its dormitory facilities in 1979. Suffolk University, the New England School of Law, and Berklee School of Music all rehabilitated their facilities. (Table 2 in the Physical Development Appendices provides a list of recent expansions.)

Medical and educational facilities currently account for over seven million square feet, more than ten percent of the total gross floor area, in Central Boston. Most of this space is devoted to the activities of major hospitals such as Massachusetts General Hospital and the New England Medical Center.

NEMC, located in Chinatown, is the largest institutional complex downtown. Though MGH and NEMC stand out as the largest medical institutions in Central Boston, the Longwood

Medical Area in the Fenway serves as a center for health care and research. Within its boundaries are six hospitals, the Harvard Medical School, Massachusetts College of Pharmacy, a major state mental health center, as well as several educational institutions.

Educational facilities occupy less space than do medical facilities, but their physical presence in Boston, and especially in Central Boston, is nonetheless significant. Geographically, the Fenway has the greatest concentration of colleges and universities, including the city's largest — Boston and Northeastern Universities. Suffolk University, New England School of Law, and Emerson College are all located downtown, and together they fill over half the educational space in Central Boston.

INSTITUTIONAL DEVELOPMENT PROJECTIONS

Medical institutions are expected to grow more than most other industries in Boston in the 1980s. As the demand for medical care rises, employment is projected to increase by eighteen thousand people by 1992, as noted in Table V-I. Several factors account for this high growth prediction. First, the elderly will constitute an increasingly greater proportion of the population nationally and locally, and people in this age group will continue to have greater health care needs than do younger groups. Second, as health care needs grow nationwide, institutions in Boston — the country's center for medical care and research facilities — will expand to meet those needs. Third, recent trends in-

**Table V-1 Institutional Employment Growth Projections
City of Boston and Central Boston 1982-1992**

	1982	1992	Change 1982-1992	
			Number	Percent
Medicine & Health:				
City	63,303	81,344	18,041	28%
Central Boston	17,698	22,742	5,044	29
Education:				
City	25,149	24,772	- 377	- 1
Central Boston	15,619	15,385	- 234	- 1
Cultural/Theatre:				
City	2,929	3,371	442	15
Central Boston	1,951	2,246	295	15
Social/Non-Profit:				
City	18,649	23,497	4,848	26
Central Boston	14,922	18,799	3,877	26
Total Institutional:				
City	110,030	132,984	22,954	21
Central Boston	50,190	59,172	8,982	18

Source: Boston Redevelopment Authority, "Boston Tomorrow: Background on Development," September 1983.

dicate that medical institutions are increasing their levels of capital investment with the support of public and private funds. Examples of this trend are recent expansions by MGH, BWH, NEMC, and Beth Israel Hospital.

Increased emphasis on research activities, the need for medical office space, and institutional consolidation to provide improved care and economies of scale have fueled many development projects, as noted previously. The State's health care cost containment legislation could dampen growth in the 1980s but, given the strength of the health care providers and current national growth trends, such legislation is unlikely to significantly affect long-term growth.

Institutions of higher education, which expanded substantially to accommodate the post-World War II baby boom, will not increase their employment levels in the 1980s. Though educational institutions now account for one-fifth of institutional em-

ployment in Central Boston, that share may decrease slightly as levels of employment grow in medicine. Enrollment at Central Boston's largest educational institutions might decline due to fewer high school graduates and the low national birth rate. However, some schools are developing or expanding vocational and adult education curricula in an attempt to counter declining enrollments.

Institutional development projects slated for completion between the beginning of 1983 to 1986 will add over half a million square feet to Central Boston's institutional inventory. Medical institutions will expand more than others. (Table 2 in the Development Appendices lists institutional development projects slated for completion by 1986.)

DEVELOPMENT ISSUES

Institutions have played a key role in the city's growth. Providing jobs and public services, they have added to the local

economy and to Boston's reputation as a center for medicine and education. Some institutions' physical development has benefited Boston's architectural character. MGH, for instance recently relocated its old and distinctive physicians' residence to a prominent location on Cambridge Street, rather than demolish it to make way for expansion. Other institutions, such as the Children's Museum and the Institute for Contemporary Art, have created new uses for obsolescent buildings. The Museum relocated from Jamaica Pond to renovated buildings on the waterfront, and ICA renovated an old firehouse on Boylston Street.

However, not all of this growth has been positive. Aggressive expansion has reduced the city's housing supply. Institutional expansion into adjacent Central Boston neighborhoods, such as the Fenway, Back Bay, the South End, and Chinatown, has led to residential displacement, particularly for the elderly population.

Institutional growth can have a negative effect on the City fiscally, if that growth is not carefully controlled. The non-profit status of institutions exempts them from local property taxes. In Boston over sixty percent of property is tax exempt. While a large portion is owned by the Federal, State, and City governments, medical and educational institutions account for over fifteen percent of the total exempt property. Their share has increased substantially over the past fifteen years as institutions acquired space to expand. Now that the City's ability to generate additional revenues is con-

strained by Proposition 2½, it becomes especially important to carefully review development proposals which would increase the percentage of tax-exempt land.

Though not all institutional growth has generated such direct and severe impacts, it also has not always brought the benefits it might. Too often, institutional planning has been completed in a "piece-meal" fashion and has missed opportunities to improve both the institutional complex and adjacent neighborhoods. Plans allowing a mix of uses could promote vitality in somewhat uniform institutional areas, serve the needs of people living and working there, and help improve public safety. This prospect is important where major institutional complexes, such as Tufts Medical Schools, New England Medical Center, Massachusetts General Hospital, Northeastern University, and the Longwood Medical Area, are located near key revitalization areas in Central Boston, such as Chinatown, North Station, and the Fenway.

Planning coordinated among the institutions themselves could lead to more substantial benefits for individual institutions and minimize their need to acquire additional properties for expansion. This coordination would be beneficial because, as universities and hospitals compete for students and funding, each tends to build the largest and most up to date facilities with little thought to collaborative use among institutions. Duplication of facilities often results in the unnecessary expensive use of land and capital. In the energy and service areas, institutions have developed some projects

jointly, such as Harvard's Medical Area Total Energy Plan and the Medical Area Service Corporation's activities around the Longwood area, but few research and medical office buildings are shared.

To maximize the benefits and minimize undesirable impacts of institutional growth, Boston currently employs several policy tools: in-lieu-of tax arrangements, neighborhood and zoning review, and institutional master plan requirements. Through these, the City requests institutions to help support municipal services; to provide housing and parking for students; to improve the appearance of their facilities and open space; to provide programs and facilities beneficial to neighbors; and to avoid expansion into residential areas.

One policy tool, in-lieu-of tax arrangements, allows the City to recover some of its lost real estate tax revenue in the form of direct payments and/or community services. Typically, applications for the City's approval of institutional development plans have triggered negotiations for in-lieu-of-tax arrangements. Often, existing arrangements are updated when institutions propose additional expansion projects and are revised to reflect the increased demand for municipal services that new facilities will create.

The City has signed in-lieu-of-tax agreements with the major educational institutions such as Boston University, Suffolk University, New England School of Law, Northeastern University, and Berklee College of Music. Groups within the medical community which have made agreements with the City include

Massachusetts General Hospital, Brigham and Women's Hospital, New England Medical Center, the Harvard Community Health Plan, Deaconess Hospital, and the North End Community Nursing Home.

A second policy tool, neighborhood and zoning review, can be used to control the impacts of institutional expansion. In the Fenway, institutional zoning for the East Fens, West Fens, and St. Botolph areas has led to additional public input for institutional proposals. Most institutional uses require approval of the City's Zoning Board of Appeals as conditional uses, and any changes are subject to community and City review.

A third tool used to guide institutional growth is the City's policy requiring that institutional master plans accompany development plans. In its recent review of New England Medical Center's proposed expansion, the City withheld its approval pending submission of an acceptable master plan, one that addressed the residential needs of Chinatown.

In summary, the growth of medicine and education is an important component of Boston's economy, but institutional expansion is not without attendant problems for the City's tax base and neighborhoods. Development policies can minimize the negative effects of institutional growth and, in fact, have already done so. Development policies can also help to elicit substantial benefits from institutional growth, but this will require more coordination amongst the institutions, the City, and its neighborhoods, and it will depend on the quality of institutional planning itself.



Introduction

The employment growth forecasted for Boston's commercial and institutional sectors promises additional job opportunities for the city's present and future labor force. With that growth, the need for housing in Boston will also increase. Meeting that future demand and alleviating the current shortage of decent, affordable housing in Boston presents challenges which the City will address in formulating development strategies and policies.

Changes in demographic trends, such as the increase in the number of smaller households; rising costs of development; and the reduction in Federal housing subsidies have constrained the residential market and have generated some of the housing issues confronting the City and its residents today.

First, while the overall number of housing units in Boston has increased slightly, the changes in the characteristics of the population and their lifestyle preferences have already increased the demand for residential units well beyond anticipated residential development.

A second issue is the high cost of housing, which restricts residential opportunities for people with low and moderate incomes. Although some of the residential development projects now under construction will include subsidized dwelling units, current Federal housing policy will significantly reduce the number of subsidized units constructed during the next decade. This is of major consequence in Boston, where twenty percent of the residents receive some form of housing subsidy. In the absence of Federal subsidies, the private market will be less able and willing to provide new, affordable housing. In those

parts of Central Boston where residential developers face stiff competition from commercial and institutional developers for limited real estate, prospects for affordable housing have diminished.

Third, although change and residential mobility are natural phenomena in neighborhoods; inflation, housing rehabilitation, and conversion of rental units to owner-occupied housing often force residents to move involuntarily. Many residents have few options when threatened with displacement.

These issues affect the dynamics of Central Boston's housing market, as well as housing in all of Boston's neighborhoods. Because downtown development significantly influences the demand for housing throughout the city, this study is an appropriate means for addressing the issues summarized above and for ascertaining how development strategies for Central Boston might alleviate some of the problems facing current and potential residents of the city.

RESIDENTIAL TRENDS AND CHARACTERISTICS

• City-Wide Trends

Boston's housing has changed significantly over the past two decades. The changes are reflected not in the number of units but in the composition and location of the housing supply, forms of tenure, and characteristics and needs of residents.

The total number of units has increased only slightly, growing from 238,800 in 1960 to 241,400 in 1980, as Table VI-1 notes. Though the supply of housing shows little net growth, it has fluctuated over the past twenty years. Between 1960 and 1970, there was a net loss of six thousand units. In the following decade, the net addition of nearly nine thousand units more than restored the previously diminished supply.¹

Composition of the housing supply changed more dramatically. Boston lost nineteen thousand units of one-to-four family, owner-occupied housing during the 1960s.² Nonetheless, owner-occupancy increased by eight thousand units in the 1970s. Changes in tenure, rather than new construction, accounted for this growth. Nearly four thou-

sand owners moved into previously rented units, and forty-five hundred units went into condominium ownership. Only twenty percent of the condominiums were newly constructed. Between 1970 and 1980, the majority were established through changes in the existing housing mix: 1,780 luxury apartments were converted to an equivalent number of condominiums; 1,913 moderately priced rental units were redesigned to create 1,677 condominiums; and 722 rooming house units were combined into 247 condominiums.³

As owner-occupancy increased, the supply of market-rate rental units diminished. In the 1970s, there was a net decrease of two thousand units. Subsidized housing assumed a greater share of the housing inventory, growing by about eighteen thousand units in the 1970s. Costs of renovation, new construction, and financing rose, creating disincentives for residential development. The assistance of Federal Section 8 and State-financed programs countered changing economic forces to some extent and attracted residential developers to the subsidized market. As a result,

the number of assisted units in the city rose to forty-two thousand in 1980. (Table IV-2 outlines these changes by neighborhood.) Even with the additional units, demand for subsidized housing outpaced the supply. Although the costs of housing increased only slightly less than the rate of inflation for the period, tenants whose incomes did not increase felt the rise in costs. On the other hand, some owners found the rental increases insufficient for maintaining their property. City-wide, rents had increased by ninety-six percent between 1970 and 1980, and the price of homes climbed by eighty-four percent.⁴ In the same period, the vacancy rate for available, habitable units dropped from six percent to less than four percent.

Demographic characteristics of residents have changed, as have their housing needs. Though Boston's population declined by twelve percent between 1970 and 1980, the number of households remained constant. However, the number of families declined and large households were replaced by substantial increases in the number of small, one-to-two person households. Changes in household size, reflecting the lifestyle preference of the post-war baby boom population, have produced the current demand for homeownership.⁵

Though the net population declined between 1970 and 1980, the percentage of minority and female-headed households increased. Housing patterns of these groups reflect their generally low incomes. Homeownership is low; minority and female-headed households need

Table VI-1 Boston Housing Units, 1980 and 1970

	1980	1970	Change 1970-1980	
			Number	Percent
Back Bay-Fenway	23,677	23,136	541	2.3%
Beacon Hill-West End	8,841	8,629	212	2.5
Waterfront-North End	6,556	4,727	1,829	38.7
Charlestown	6,122	5,199	1,003	19.6
South End	14,942	11,849	3,093	26.1
Central Boston Total	60,138	53,460	6,678	12.5
Boston Total	241,444	232,448	8,996	3.9

Source: 1980 and 1970 Census of Population and Housing.

Table VI-2 Changes in the Supply of Market-Rate Rental and Subsidized Housing Units 1970-1980

	1970		1975		1980	
	market	subsidized	market	subsidized	market	subsidized
Back Bay/Fenway	20,800	600	20,700	1,700	20,000	3,800
Beacon Hill/West End	6,800	—	7,400	—	7,300	400
Waterfront/North End	2,800	—	3,500	100	3,200	400
Charlestown	300	1,100	300	1,700	300	1,700
South End	6,300	1,200	6,300	3,300	5,900	4,500
Central Boston Total	37,000	2,300	38,200	5,800	36,700	10,800
Boston Total	151,000	22,000		32,900	144,500	42,000

Source: Boston Redevelopment Authority, "Boston's Housing in the 1980s," September 1980.

more subsidized housing and family-sized units. These are among the findings of a study by the MIT-Harvard Joint Center for Urban Studies entitled "Future Boston: Patterns and Perspectives".⁶

• Central Boston Trends

Viewed in a city-wide context, housing in the study area provides an important source of revenue and supplies a major share of particular housing types. Central Boston's housing inventory includes much of the city's rental stock — about half of its apartments and an equivalent supply of mixed residential/commercial property. The area also supports approximately thirteen percent of the single-family property in the city (this count includes units owned as

condominiums), nearly five percent of the two-family structures, and over seven percent of the three-family buildings.⁷

The housing market in Central Boston has reflected many city-wide trends of the past decade, such as the growth of condominium and subsidized housing, higher property values and rents, and smaller household size. But trends affecting Central Boston's market have departed from other general trends. Housing stock increased by eleven thousand units while the number of units city-wide remained constant. The number of people living in Central Boston grew by nearly three percent at a time when the city's total population declined.

• Central Boston's Neighborhoods

A composite of housing in Boston, or even in Central Boston, shows overall trends but cannot provide an adequate picture of housing issues confronting sub-areas within the city. Characteristics and needs of residents, composition of the housing inventory, and the potential for residential development vary among the city's distinct neighborhoods. The following section outlines some similarities and differences of Central Boston's neighborhoods and describes housing trends and issues that residents face.

Back Bay and the Fenway supply a large proportion of Central Boston's housing, much of it in rental units. Though the number of units increased slight-

Table VI-3 Summary Characteristics of Central Boston Neighborhoods 1970-1980

	Population	Change in Population 1970-1980	Change in Households 1970-1980	Black	Aged 65 and Over	Units Owner-Occupied	Change in Owner Occupancy 1970-1980	Average Household Size	Change in Average Household Size 1970-1980	Families as Percent of Households	Change in Families as Percent of Households
Back Bay-Fenway	49,517	— 4.6%	— .2%	9.5%	7.3	9.7%	225.1%	1.5	2.0%	18.2%	— 21.4%
Beacon Hill-West End	14,894	9.5	4.7	3.0	11.1	13.8	82.1	1.6	8.9	24.7	— 6.4
Waterfront-North End	11,639	5.1	34.1	1.5	14.2	15.1	51.3	1.8	— 22.8	38.5	— 38.0
Charlestown	13,364	— 13.0	9.0	.2	12.4	32.1	7.7	2.5	— 14.0	58.9	— 19.3
South End	29,611	20.8	30.3	26.6	8.2	12.7	46.3	2.0	12.6	36.8	— 9.6
Central Boston Total	119,025	— 2.2	11.0	11.1	10.1	15.9	63.6	1.8	— 8.3	30.0	— 16.3

Source: 1980 Census of Population and Housing, based on Census Tract Districts.



Table VI-4 Occupied Housing Units by Occupancy Tenure for Central Boston 1970-1980

	1980 Total Housing Units	1980 Renter Occupied Housing Units	% Renter Occupied	1980 Owner Occupied Housing Units	% Owner Occupied	1970 Total Housing Units	1970 Renter Occupied Housing Units	% Renter Occupied	1970 Owner Occupied Housing Units	% Owner Occupied
Back Bay-Fenway	21,285	19,211	90.3%	2,074	9.7%	21,327	20,689	97.0%	638	3.0%
Beacon Hill-West End	8,261	7,125	86.2	1,136	13.8	7,865	7,241	92.1	624	7.9
Waterfront-North End	5,952	5,053	84.9	899	15.1	4,463	3,869	86.7	594	13.3
Charlestown	5,252	3,567	67.9	1,685	32.1	4,840	3,276	67.7	1,564	32.3
South End - CBD	13,115	11,449	87.3	1,666	12.7	10,071	8,932	88.7	1,139	11.3
Central Boston Totals	53,865	46,405	86.2	7,460	13.8	48,566	44,007	90.6	4,559	9.4
Boston Totals	218,456	158,953	72.8	59,503	27.2	217,587	158,309	72.8	59,278	27.2

Sources: 1970 U.S. Census of Population and Housing; 1980 U.S. Census of Population and Housing.

ly (2.3 percent with the addition of five hundred units) between 1970 and 1980, the supply of market rate rental units has dropped. In 1970, apartments comprised ninety percent of the two neighborhoods' housing stock but by 1985, the percentage is expected to fall to about sixty percent.⁷

Back Bay's central location, rising market values and the character of the housing stock all encourage and support condominium development. Over two thousand rental units were converted between 1969 and 1979.⁸ While the rate has diminished somewhat, condominium conversion still continues,⁹ and threatens to displace elderly tenants, long-term residents of the area. The majority of the area's residents are middle and upper income professionals whose earnings afford them a wider range of housing options; displacement is a less serious issue for them.

In contrast, the Fenway houses a large student and elderly population which is generally less affluent than that of Back Bay. The real estate market and overall neighborhood stability of the Fenway suffered during the 1960s, due to arson, real estate speculation,

housing abandonment, and institutional expansion. With the infusion of large housing subsidies in the 1970s, the development of some luxury apartments and condominiums, and the increased activity of neighborhood groups, the area is becoming more stable. However, the potential displacement of the low-income and elderly residents, reductions in federal subsidies, and high housing costs will be critical concerns throughout the next decade.

Beacon Hill and the West End are neighborhoods of Boston's affluent residents, and property values are higher than in many residential areas. The supply of housing has increased slightly, especially in the West End, as has the population. Condominium conversion, which occurred at a rapid pace on Beacon Hill in the 1970s, continues with the recently announced conversions of River House, Bellevue Hotel, and Tremont on the Common.¹⁰ As in Back Bay, displacement of the elderly population and housing affordability are issues of concern.

The North End, traditionally a tightly-knit Italian community, has become attractive to newcomers due to the neighborhood's proximity to Downtown,

Faneuil Hall Marketplace, and the adjacent, revitalized Waterfront. The demographic characteristics of the area are changing dramatically. The percentage of households that are families living in the North End and Waterfront has decreased from sixty-four percent in 1970 to forty-two percent in 1980, and the number of single-person households has increased. Half the residents in the two neighborhoods now live alone. Housing development along the waterfront accounts for much of the change. Underutilized warehouses and wharf space have been converted to luxury rental units and condominiums. The addition of eighteen hundred units of owner-occupied, market-rate rental, and subsidized units — a thirty-nine percent increase in the total North End/Waterfront stock — has created a dynamic market there. Demand is expected to remain strong and affordability to be a major concern.

Housing in the South End has improved, reversing the deteriorated conditions that led to the area's Urban Renewal designation. The housing supply increased by over twenty-five percent between 1970 and 1980. Population in the area rose by

about twenty percent, and the incidence of owner-occupancy is expected to do the same over the next decade. However, new residents are more affluent than most long-term residents living in the area. Condominium conversion and owner-occupancy of rental units have contributed to the loss of apartments and rooming houses, creating problems of displacement and affordability. The addition of four thousand units of subsidized housing partially alleviated the problem, but conflicts over if and where residential development will take place on vacant land continue to occur in the South End.

Charlestown, the smallest of Central Boston's neighborhoods, is populated primarily by moderate income residents. Sixty percent of the housing there is in one-to-four family owner-occupied buildings. With the addition of several hundred units in the 1970s, thirty percent of the housing stock is now subsidized. Family size is declining in Charlestown, as elsewhere in the city, but at a higher rate than in some neighborhoods. The average age of residents is increasing, and the population has fallen by eighteen percent. Although there was a loss of homeownership during the early and mid-1970s, middle and upper income professionals began to migrate to Charlestown during the late 1970s. The Navy Yard development will add one thousand market-rate rental and condominium units to the neighborhood over the next five years and will inevitably affect the socio-economic mix of the Charlestown community. As elsewhere, housing affordability

will be a main concern in Charlestown in the coming decade.

Boston's Downtown is comprised of several distinct subsections, including the Theater, Leather, and Financial Districts; South Station, Chinatown, and South Cove. Consonant with the image of a downtown, most of the land uses found there are commercial, manufacturing, or office uses. Physical deterioration, building obsolescence, and changing market forces are now creating opportunities for new residential uses in this predominantly business district. In particular, the Leather and Theater Districts are areas where new residential development, achieved primarily through adaptive building reuse, is already occurring and is likely to accelerate in the coming decade.

The recent introduction of housing Downtown has been privately financed and is increasing primarily the condominium stock. The lack of housing subsidies and the limited range of tenure options are likely to restrict housing in this part of Central Boston to a small segment of the population. As planned commercial development projects take place, the desirability of these areas for residential occupancy will be enhanced.

The stability of residential Chinatown is threatened by intensive development pressures resulting from the construction of Lafayette Place, the renovation of the South Station area, the revitalization of the Leather District and the Park Plaza area, and continuing expansion and development of Tufts University

and New England Medical Center. Through the re-use of vacant manufacturing buildings, the decline of the garment industry could afford new opportunities to accommodate Chinatown residents' critical need for housing units. As elsewhere, financial considerations are primary and residential development will need subsidies to make it affordable to the low and moderate income population.

The Chinese community extends beyond the borders of Chinatown. Many Chinese live in South Cove, and others are moving into housing on lower Washington Street and in the South End. South Cove is comprised of institutional and residential land uses, with supportive residential services. Since 1970, approximately six hundred units of assisted housing have been constructed and are occupied primarily by Chinese residents. Only a few outstanding Urban Renewal parcels are available for development, and they could be put to residential use. Tufts Medical Schools and New England Medical Center, located in the South Cove area, are planning major capital development projects to expand and improve the quality of education and medical services. However, this expansion might reduce the housing stock available in the area. Any further development programs proposed by these institutions must incorporate provisions for accommodating the residential needs of the community.

DEVELOPMENT ISSUES

Over the past two decades, several residential trends have

emerged. First, the supply of one-to-four family, owner-occupied housing has declined, and the desire for homeownership increasingly is being met through condominiums. Condominiums may satisfy the growing demand for smaller homes, which has resulted from decreasing household size and increasing energy costs. However, the cost of condominiums may be prohibitive for low and moderate income residents. Given current interest rates and inflated market values, only a very small segment of the population can afford the down payment and carrying costs associated with this type of homeownership. Hence, homeownership alternatives for moderate-income families have diminished.

Though Central Boston is expected to retain its rental character, the ratio of owner-occupied to rental units is shifting. Owner-occupancy increased by over four percent between 1970 and 1980, growing by over six percent in the Back Bay/Fenway and Beacon Hill/West End areas. The percentage of rental units declined by over four percent in the same period. In each neighborhood, rates at which the number of rental units declined closely approximate rates at which owner-occupancy increased. This trend is likely to continue.

Another housing trend which emerged during the past twenty years was an increase in the supply of subsidized dwellings. Changing economic forces rendered subsidized development a profitable venture, attracting large residential developers. Although each of Central Boston's neighborhoods experienced

growth in their subsidized stock during the 1970s, the overwhelming majority of units were located in the Fenway and the South End.

The number of market-rate rental housing units within the study area has declined since 1970. Low and moderate income households, especially those of the elderly, will be adversely affected if condominium conversions continue. Although displacement poses some hardship in any housing market, the low vacancy rate and high rent levels which typify the current market further exacerbate the housing problems of less affluent groups.

The dynamics of development in Central Boston complicate attempts to maintain neighborhood stability and to improve housing options. Legitimate needs for jobs and revenue generated by commercial development often conflict with equally legitimate needs for housing. Such is the case in some neighborhoods described previously, particularly in those, such as Chinatown, which abut Downtown. While commercial development may act as a catalyst for some residential development, the City's development guidelines need to continue to address how residential and commercial projects will affect current neighborhood residents.

The City recognizes the opportunity that commercial development can offer for providing housing funds: the proposed Arlington-Hadassah project will contribute a minimum payment of 600,000 dollars and the Rowes/Fosters Wharves project will provide a minimum of 500,000 dollars annually as

part of its lease agreement with the City of Boston. Funds from both projects will be used to generate housing for low and moderate income households. Commercial development forecasted for the coming decade will afford similar prospects for supporting residential projects.

NOTES

1. 1970 and 1980 U.S. Censuses of Population and Housing.
2. Rolf Goetze, "Boston's Housing in the 1980s: Challenges and Opportunities", Boston Redevelopment Authority, September 1980, p. 51.
3. Bonnie Heudorfer, "Condominium Development in Boston", Boston Redevelopment Authority, September 1980, p. 28.
4. Fred C. Dolittle, George S. Masnick, Phillip L. Clay, Gregory A. Jackson, "Future Boston: Patterns and Perspectives: The Joint Center for Urban Studies and Planning of MIT and Harvard University, 1982, p. 62.
5. *Ibid.*, p. 64-65.
6. *Ibid.*, p. 65.
7. Goetze, "Boston's Housing", p. 56.
8. Heudorfer, "Condominium Development", p. 28.
9. Koren Buglass, "Condominium Update: January through August 1980", Boston Redevelopment Authority, March 1981, p. 1.
10. *Ibid.*, p. 1.

Introduction

Growth and change in Central Boston in recent years has significantly reshaped the city's form. With the increase in office-related employment, the skyline, which was once dominated by the State House dome, Custom House Tower, and church steeples, is now punctuated with tall buildings from the Financial District to the Fenway. Economic changes have altered some patterns of land use: housing, hotels, and parks, for instance, have replaced maritime trade along parts of the waterfront. Modern building technologies and architectural design have generated forms, such as the John Hancock Tower, that were unimagined at the time Faneuil Hall was constructed.

Similarly, development which will accompany social, economic, and technological change in the next ten years will alter the design of Central Boston. The potential impacts of that development raise controversial issues about the future design of Boston's downtown. Today, Central Boston's form is characterized by its modest scale, the rich and complex fabric of its districts, and its diverse architectural legacy. While that form is not without its attendant problems (as noted in this chapter), it defines the unique image of the city and constitutes much of Central Boston's appeal as a place to live, work, and visit.

The debate over growth and change centers on the conservation of the city's present scale and design at a time when new technologies and the real estate market foster increasingly larger development proposals. Guiding the location and form of future development in ways which are compatible with the city's present character and which improve the quality of life in Boston, will require careful and imagi-

native planning and a full exploration of the many factors which shape the city. To initiate such a process, Central Boston is considered from three perspectives: from the bird's-eye-view, from the street level, and on the time continuum.

Central Boston is considered first from the bird's-eye-view to determine how new development could strengthen the form of the area, its circulation networks, the distribution of land uses, and the integrity of existing districts.

Next, Central Boston is viewed at the street level, where the design of buildings and public spaces affects people's experience of the city. The positive and negative impacts of development on the public environment are important considerations in formulating a development strategy and guidelines.

Finally, the form of Central Boston is considered on the continuum of time, a fundamental consideration in managing urban growth. The area's historic design includes valuable assets and contributes to people's sense of continuity with the past. Maintaining that legacy, while encouraging development to meet future needs and opportunities, is a third aspect central in formulating design policies.

The goal of the urban design strategy and guidelines for Central Boston is to provide a framework which fosters individual initiative and creativity, coordinates private developments with the public interest, and enhances Central Boston's appeal as a place to live, work, visit, and invest.

CENTRAL BOSTON FROM THE BIRD'S-EYE-VIEW

The process of formulating an urban design strategy and guidelines for Central Boston begins with an assessment of Central Boston as a whole: its cityscape, circulation networks, and distribution of land use, and districts. Central Boston is considered from an overall perspective to determine how it now functions and how development might help to improve its organization and design.

CITYSCAPE OF CENTRAL BOSTON

The overall composition of Central Boston's natural features and man-made elements establish its cityscape, or urban geography, which has been extensively altered over time. Changes in the urban geography are likely to accompany development in the next ten years, affording opportunities for enhancing the cityscape and for strengthening some of its essential features. Understanding how the cityscape has changed and how it might be improved are important steps in preparing design guidelines.

Central Boston's boundaries have expanded since the 1700s as land fill operations in Boston Inner Harbor and the Charles River Basin have tripled the city's land mass. Nonetheless, its location on a peninsula has limited Central Boston's expansion, creating both the vitality and congestion which accompany high density. Because of its compactness, Central Boston is traversable on foot, and a rich variety of buildings, public spaces, and activities are acces-

sible within a relatively small area.

Within its boundaries, a number of components establish Boston's identifying structure. Boston Harbor, the Charles River Basin, and Beacon Hill are the key natural elements of the cityscape. Although their prominence has diminished, shoreline variations and the grade changes derived from the remnants of the three original hills establish the natural topography of Central Boston and lend some variety to the urban form. Historically, Boston was strongly oriented to the water, and the south slope of Beacon Hill, where major public buildings were constructed, provided a vantage of the Harbor and downtown. Washington Street, originally the main thoroughfare, continues to serve as the major commercial spine. The loosely radial pattern of streets down from the centers of commerce and government to the shore still prevails, although the sense of connection between the heart of the city and the shore is not as strong as it was in the era of maritime trade.

Where there are views and vistas of the water, the expanses of the Harbor and the Charles River contrast with the dense urban form and stand out as key elements of the cityscape. Within the heart of downtown, the Boston Common and Boston Public Garden provide similar counterpoints to the built environment; these two parks remain the central open space in Boston.

Over the years, development has blocked many views of the water from the street and

weakened the position of Boston Harbor as a major element of the cityscape. Recent development along the edges of the Common has done little to define it as a centerpiece of the city. Some projects, such as Waterfront Park, have led to a renewed interest in the Harbor, and additional development which facilitates access and provides a mix of maritime and other uses will help to re-establish a connection between the city and the shore.

The sense of Boston's cityscape also grows out of views to and from its tallest structures. Throughout the city, the roofs, domes, and steeples of Boston's public buildings once articulated the skyline. Today, office and apartment towers create a new topography and set of vertical elements which symbolize the city. They offer their occupants panoramic views of Boston and the water, increasing the visibility of the cityscape. While the advent of skyscrapers has given people a new pleasure and perspective of the city, the crowding of towers has lessened this advantage. The effects of tall buildings on Boston's overall design and on people's perception of the city will be an important consideration of development policy, in addition to the street level impacts discussed in this chapter.

The cityscape created by the shoreline and hills and by Boston's largest open spaces, major streets, and districts create a structure, compactness, and overall character which are important to consider in preparing Central Boston's development strategy. Development can con-

tinue to reconnect Boston to the water, increasing public access and the variety of uses within Boston Harbor and strengthening links to the waterfront. Design of buildings and spaces can take advantage of and reconnect topography and views by providing interesting grade changes and overlooks. The design guidelines will consider how development can enhance Central Boston's urban geography. Through urban design guidelines, the City will guide changes in Central Boston's form to protect existing views and vistas of major features, to strengthen linkages between Central Boston and its water boundaries, and to highlight central elements of its cityscape, such as the Common.

CIRCULATION NETWORKS

Changes in the transportation systems to and within Central Boston have clearly affected the form of the area and the accessibility of its various parts. Since World War II especially, the city has been dramatically shaped by the automobile which has generated traffic congestion; conflicts amongst pedestrians, motorists, and trolley cars; parking problems; and air and noise pollution. As development takes place in the future, it is important to consider how improvements to the public transportation, pedestrian and vehicular networks could be designed to enhance the overall form of Central Boston and its various districts.

- **Public Transportation**

Public transportation systems,

including rapid transit, buses, commuter rail, and ferries, significantly shape the form of the city. The location of public transportation lines and terminals determine points of access within Central Boston, influence levels of ridership, and affect the distribution of development. Transit projects can help to attract development to underutilized areas. The vicinity of South Station, for instance, is now a major focus of renewal as the station itself is being redeveloped. The integration of transit stations within development projects, such as the inclusion of the Aquarium Station in the Marriott-Long Wharf Hotel, can benefit both transit riders and businesses and offers opportunities to improve the design of existing stations. Waterborne commuter travel within the Inner Harbor and to points on the North and South Shores can provide similar chances to integrate transit improvements with development projects; it can also improve the design of the waterfront. The docking facility proposed with the development of Rows/Fosters Wharves is a step in this direction.

Guidelines which reinforce the use of public transit through the location and design of terminals and stations will be important components of Central Boston's development strategy. Equally significant, the effect of transit development on the overall form and structure of Central Boston and the compatibility of that development with surrounding areas will require careful consideration.

- **Pedestrian Network**

Streets, alleyways, and interior corridors link areas of the city and establish the pedestrian network of Central Boston. The patterns of the network constitute much of the appeal of walking in the city. As people move throughout the city, landmarks, such as domes, towers, and natural features, often mark memorable and significant locations. Views and vistas of these elements help people to orient themselves in the somewhat confusing street network of Central Boston. Open spaces encountered along the way, such as Boston Common, Boston Public Garden, and numerous small parks, improve the walk. When open space is thought of as part of a pedestrian system, as it was when Frederick Law Olmsted designed Boston's Emerald Necklace of parks, the sequence of ways and spaces reinforce one another and help give structure to the city.

The maze of narrow streets constitutes part of the delight of walking in parts of Central Boston but also creates conflicts between pedestrians and motorists. In some areas, such as Downtown Crossing and Faneuil Hall Marketplace, restricting vehicular access to create special environments for pedestrians has eliminated the conflicts. In other areas, segregating pedestrians and vehicles may not be feasible or desirable: vehicular traffic can add to the activity and hence, the public security along some streets. Employing other strategies, such as widening sidewalks, can minimize the hazards of walking downtown. Design

guidelines can reinforce the informal pedestrian network in Central Boston by encouraging developers to provide additional pedestrian connections and to strengthen the network with well-designed open spaces and interior and exterior passageways. In formulating development strategies, the effect of development on the overall quality and organization of the pedestrian network will be a major concern.

- Vehicular Networks

Some dramatic changes in Central Boston's form have occurred with improvements to vehicular networks. The construction of new highways and streets has significantly increased vehicular capacity to and within the area, but it also has cut through neighborhoods and created some inappropriate visual and physical barriers within the city. For instance, the Central Artery creates a wall which separates the North End and the Waterfront from Downtown; Storrow Drive cuts off residential Back Bay and Beacon Hill from the open space of the Esplanade and Charles River Basin; and the Massachusetts Turnpike separates the Back Bay from the South End. Depression of roadways and the development of air rights over them are costly but effective means for eliminating barriers. However, development of the sizeable property created by such roadway reconstruction must be carefully planned because it too could create inappropriate barriers.

Reconstruction of the Central Artery and other major roadway

proposals, including a seaport access road, a third harbor tunnel, and realignment of Northern Avenue, may improve vehicular access and strengthen linkages to parts of Central Boston from elsewhere, opening views of the water, and improving the design of adjacent areas.

The local street network, as well as that of major roads, has influenced the form of the city. Its structure ranges from the orderly grid of Back Bay to the mazelike layout of North End streets, adding to the diversity of the urban fabric. The width and length of streets have helped to establish the human scale of many districts. However, having evolved over the years, downtown streets are characterized by varying widths, discontinuities, and awkward alignments and intersections.

The design of local streets, sometimes referred to as "cowpaths", can be frustrating for motorists, create conflicts between pedestrians and vehicles, and impede truck deliveries. Reducing these conflicts while maintaining the scale and character of the local streets, is a goal of development policies for Central Boston.

It is important to ensure that the alteration and construction of streets and roads meet their potential for enhancing Central Boston's overall organization and accessibility and that projects designed to improve access will not disrupt the scale and character of neighborhoods and districts. In addition to guiding the design of transportation projects, it is important to the City to identify where and how other types of development

might improve the appearance, convenience, and safety of the various circulation networks.

LAND USE

Public policies and private initiatives, along with significant natural features and circulation networks, over time have determined the existing patterns of land use in Central Boston, the location of major activity centers, and the character of particular districts. New projects can create subtle or dramatic shifts in the existing patterns, influencing the vitality of some economic sectors and the organization and form of the city. To ensure that the future distribution of land use enhances the design, convenience, and diversity of activities in Central Boston; guiding the location and mix of uses in proposed projects will be an important component of the City's development strategy.

The traditional centers of activity—Hanover Street, Faneuil Hall, Washington Street, the Financial District, and Back Bay—were well-established by the late nineteenth century, as were the location and character of many Central Boston neighborhoods. Economic changes over the next half a century altered the distribution of land uses on a relatively small scale. For instance, commercial uses came to occupy more space in Back Bay, and the shoe and leather industry relocated three times before settling along South Street.

Land use changes have occurred on a grander scale and at a more rapid pace in the past three decades. Urban Renewal

has altered major activity centers and some neighborhoods to accommodate new uses, streets, parks, and buildings in places such as Government Center, the Waterfront, the South End, and Charles River Park. In addition to these redeveloped areas, the expansion of major institutions, such as the Christian Science Center, Tufts Medical Schools, New England Medical Center, the Longwood Medical Area institutions, Northeastern University, and Massachusetts General Hospital, have had a major impact on land use patterns, city form, and the functional relationships amongst and within parts of Central Boston. The growth of finance and professional services has fueled the construction of office towers, especially in the Financial District, altering the cityscape and skyline of Central Boston.

Less dramatic but nonetheless significant changes have come about through small-scale land use decisions. The relocation of the Children's Museum from Jamaica Pond to renovated quarters on Museum Wharf and the move of some garment manufacturers from Chinatown to the redeveloped Army Base are examples of land use decisions which have altered the form and character of Central Boston at this scale.

Land use decisions in Central Boston have had both positive and negative impacts on the organization, form, and quality of life in Central Boston. The predominance of a single use in some areas has helped to establish districts and neighborhoods. The concentration of firms in the Financial District marks that as a

specialized area, one that is somber in contrast to the lively ambience of the adjacent Faneuil Hall Marketplace. Government Center's predominant use, implicit in its name, sets it apart from areas with a greater mix of uses; its monumental form strengthens the district's identity. The concept of specialized districts helps people to mentally organize the city and is important in a city as complex as Boston.

Although particular uses distinguish some parts of Central Boston, a rich mix of uses is characteristic of most districts and neighborhoods. Back Bay supports housing, commercial, office, manufacturing, and institutional uses; Chinatown has a similar mix; the North End contains commercial, office, and residential uses.

The diversity of uses in these areas affects their design. The configuration of a single building often accommodates a range of activities, contributing to the adaptability of the city's form. Variations at the street level enliven the public environment. When the variations establish a pattern throughout a district, such as the entrances above and below grade to Newbury Street shops, such patterns help to create a distinctive identity for an area. The contrast amongst patterns found throughout Central Boston helps to establish the scale and texture of the urban fabric. A diversity of uses adds to the convenience, vibrancy, and economic well-being of Central Boston and its districts. Introducing ancillary activities in places dominated by a single use can make a district more

convenient for people living and working there, without diluting its special character. The introduction of retail uses in the Financial District can relieve the monotony of an area or of single buildings. This concept has been employed in the Shawmut Bank Building and the State Transportation Building.

Various land uses generate different levels of activity throughout the day. This factor affects the character of certain districts: parts of Back Bay, the North End, and Chinatown seem vibrant by day and night. Downtown Crossing, Government Center, and the Financial District—all highly specialized districts—are places where activity occurs primarily during the day. In determining appropriate locations for various activities, it is important to consider how their hours of operation will affect their immediate surroundings, as well as the accessibility of goods and services in Central Boston at various times of day.

The expansion of some activities, such as those of institutions and financial and professional services, has benefited Boston's economy, but sometimes at the expense of other activities, such as housing and manufacturing. These effects are described in the chapters of this report on institutions, manufacturing and housing. As noted there, it is important for the City to guide the location of development to attain a balance between highly marketable uses and those which may be less profitable but are essential to the vitality of an urban center.

A number of strategies could be employed, such as directing



development to underutilized areas and to buildings suitable for renovation, as was done with the Boston Army Base. New projects can incorporate a mix of uses, providing support services, places of employment, and residences. Design guidelines for Central Boston can help to ensure that development meets its potential as a catalyst for revitalization without adversely affecting existing activities.

Because of the complex effects of land use decisions, guiding the location and mix of uses in proposed projects will require careful consideration of the strengths and liabilities of existing land use patterns within particular districts and throughout Central Boston. Specifying uniform solutions throughout Central Boston would be to ignore the special nature of neighborhoods and districts and the value of a range of complementary and contrasting land uses within downtown Boston.

DISTRICTS

The concept of districts helps people to mentally organize Central Boston and to orient themselves within it. The distribution of land uses, natural features, landmarks, and block and building patterns are amongst the factors which distinguish districts and facilitate the organization of downtown Boston. As development takes place, new districts can form, existing ones can change character, and less distinctive ones can gain more integrity. These changes can have positive and negative impacts on the overall organization and design of Central Boston.

Consequently, controlling the impacts of development on the form and character of individual districts and the functional relationships amongst all parts of Boston is an important component of a development strategy for Central Boston. Understanding the character of specific districts in some depth and identifying design issues for the designated areas will be part of the next phase of the Central Boston Development Study.

Because Central Boston's districts are diverse, there is much to explore in the next phase. Many of Central Boston's districts are readily identifiable. Some are characterized by the dominance of specific land uses inherent in their names—Government Center, the Financial District, and the Theater District. Others, such as the North End, South End, and Beacon Hill, have long-standing status as residential areas. Some areas are distinguished by a strong pattern of blocks and buildings; this is the case in the Back Bay. In other districts, physical patterns are less clear and other factors, such as the ethnic character in Chinatown, establish the districts' identities. Still other districts are only loosely defined; their centers or sub-districts may be distinctive, but their boundaries are vague. As with the city as a whole, each district can be analyzed in terms of its overall form, transportation systems, and land use distribution; but it is important that design guidelines acknowledge the inconsistencies of boundaries and subdivisions, treating the concept of districts as a very important, but flexible, organizing

tool.

The impacts of development will vary amongst the districts. Development can make some marked improvements in a number of areas, some of which the City has already identified. Plans are proposed, underway, or completed for Fort Point Channel, Downtown Crossing and adjacent properties, the East Boston Piers, North Station, and the Theater District. Guidelines for these specific districts will fit within an overall framework for Central Boston.

In some districts, the scale of development in relation to the existing urban fabric is of utmost concern. The neighborhoods—Back Bay, Beacon Hill, the North End, the South End, Bay Village, Fenway, and Charlestown each have a finely patterned, cohesive fabric which has been preserved by tradition and the small scale of private-parcel residential use. However, relatively small changes can dramatically disrupt the texture in these districts. Preservation of the different qualities which are unique to each neighborhood are also important in these historic areas. For the Back Bay and Beacon Hill, architectural commissions have been organized to address those issues. Development policies for the Commercial Palace District have been proposed by the Boston Landmarks Commission and the BRA.

Each district must also be considered in terms of its context—how it relates in function and design to other Central Boston districts and adjacent parts of Greater Boston. For example, plans for parts of the

Waterfront, Fort Point Channel, Charlestown, and East Boston should relate to Boston Harbor as a whole. Adjacent cities and other Boston neighborhoods have symbiotic relationships with Central Boston in terms of land use, transportation, views, and images of the city. Guidelines respecting and enhancing these relationships will be part of the City's development policies.

Design guidelines will address ways to preserve and augment the unique structure and fabric of Central Boston's districts in order to improve the legibility organization of each district and the city as a whole.

CONCLUSION

Cumulatively, development in Central Boston will affect the area's organization and form, as determined by its urban geography, circulation networks, distribution of land uses, and character of its districts. Evaluating the impacts of individual development proposals on the existing urban fabric and determining how new projects can enhance the structure, form, and image of Central Boston and Boston as a whole are important City functions and will be significant components of future design policies.

CENTRAL BOSTON FROM THE STREET LEVEL

Focusing on the design of Central Boston at a smaller scale than the bird's-eye-view, this section considers how architecture and landscape architecture influence people's experience of the city at the street level. Decisions made regarding the location and design of buildings and open spaces in concert

shape the public environment, determining its aesthetic character and affecting public safety and comfort. Because of the importance of these individual decisions to the quality of the public environment and the overall form of the city, guidelines for the design of buildings and open spaces will be a major component of the City's development policies for Central Boston.

DESIGN OF BUILDINGS

The design of a building and its relationship with nearby buildings and open spaces contributes to the quality of the public environment and establishes a sense of place along particular streets. Throughout Boston's past, there have been many examples of unique and distinctive new buildings which have maintained a coherent cityscape and reflected the local character. Their designs span various eras and include a range of architectural styles. For example, the architecture along Park Street is an integrated row of buildings, ranging from Federal, to Queen Anne, to strictly modern styles. Buildings along Franklin Street also complement one another, although their styles are diverse and include Victorian, neo-grec, neo-classical revival, and art deco.

However, some recent development has failed to respect or enhance the public environment. Though the design of new buildings need not replicate earlier architectural styles to establish a safe and pleasant streetscape, it should reflect the human scale of Boston's past. Buildings with blank street walls along barren

plazas, large structures that fail to acknowledge the scale of the surrounding area and the city, and buildings with abrupt changes in materials, styles, and uses detract from the street level environment.

With the recent development in Central Boston, the scale of new buildings in relation to their surroundings has become a major design issue. A building's massing, detailing, materials, location, and use are all factors which establish its basic scale which can range from monumental to intimate.

The massing of a building is a prominent factor in determining its compatibility with the street level environment and is one of the most controversial elements of many development proposals. Massing (the height and bulk of a building and the proportions of major components of a development) has increased in recent years in response to the development process, real estate finance, and available technologies. Sizeable buildings afford some benefits: where appropriately designed and sited, tall buildings have become landmarks and are seen as an efficient use of urban land. Some activities, such as manufacturing, require the substantial floor area provided by large structures. However, buildings grand in scale can have negative impacts at the street level, altering the microclimate and character of a streetscape.

Architectural details are also important determinants of scale and can be used to minimize the perception of a building's massing. Window courses, lintels, cornices, upper floor setbacks, and rooftops established the

vertical and horizontal lines of a building. Fenestration, ornamentation, and elements such as stairs, balconies, and arcades set up architectural patterns. These lines and patterns can help to enliven the streetscape, complement surrounding buildings, and create an environment human in scale. In Faneuil Hall Marketplace, South Station, the old and new State Houses and City Halls, the straightforward massing is scaled down through delicate facade treatment. This is also the case in Boston's numerous rowhouses and commercial buildings in which the basic and repeated massing is varied through careful detailing.

With the introduction of new building materials, such as pre-cast concrete, large expanses of glass, and metal cladding, the role of building materials in determining architectural scale and the character of the streetscape has become an important design concern. Local red brick, limestone, and granite predominated in early architecture in Boston. Many new projects, while clearly expressing modern times, fit with their surroundings partly because of the use of traditional materials. The North End Community Nursing Home, the State Transportation Building, and the Ritz-Carlton addition are examples of projects where materials, as well as massing and detailing are compatible with those of the environs. Where new materials are used, the color and texture of the materials, along with the detailing characteristic of the materials, should be carefully treated to complement and enhance the streetscape.

The location and siting of a

building also affect the perception of its scale and compatibility with its surroundings. The siting of a project relative to the block and building pattern of a district is one determinant of scale and compatibility: the State Transportation Building, for example, is a large structure which fits with its environment in part because it hugs the street line. The location of large buildings relative to one another is also an issue. The negative impacts of tall buildings can be intensified, if the buildings are concentrated in a small area, such as the Financial District.

Each of the factors noted above are determinants of architectural scale. Perceptions of the appropriateness of a building's scale vary according to its context, as noted above, and also according to its use. For instance, the massing, details and facade treatment of a church is properly different from a residence and that of a commercial or office building different from a warehouse, but each can be designed at a human scale and as an integral part of its context.

New buildings symbolize urban growth and change. Their scale and design shape the streetscape, help to define the character of the city, and consequently, are the subject of debates about the future form of Central Boston. Through its design guidelines, the City can control the impacts of new buildings on Central Boston's streetscapes, while encouraging architectural innovation and creativity. Design guidelines will address issues of scale, continuity, and facade design for new and renovated buildings.

DESIGN OF PUBLIC SPACES

A second important component of people's experience of Central Boston at the street level is the design and location of public spaces. Open spaces such as the Esplanade, the Public Garden, Boston Common, and Louisburg Square are some of Boston's most distinctive and valued urban design elements. They enrich the color and texture of the urban pattern, provide a sense of relief from more built-up sections, and offer opportunities for passive and active recreation.

Historically, most open spaces were publicly developed and the City, with the assistance of Federal funds, continues to create and redesign some public spaces, such as Waterfront Park and Copley Square. However, today private development affords more opportunities for creating open spaces. To ensure that private construction projects benefit the public environment, the City will promote the inclusion of publicly accessible open spaces as part of its development strategy for Central Boston.

When thought of as an integral part of the design of a building or a large development, open spaces are most successful. The urban spaces encompassed in such projects can range from large public spaces, such as parks, squares, and malls; to more intimate ones, such as courtyards, "vest pocket" parks, and alleys; to semi-public spaces within and atop buildings.

Large public green spaces, plazas, and malls are important elements in the overall urban design of the city. As with

Copley Square, Commonwealth Avenue, Boston Common, Downtown Crossing, and City Hall Plaza, they are often the foci of particular districts. The redesign of Copley Square, presently underway, has presented an opportunity to reconsider earlier design decisions and to improve its image as the center of the Back Bay. Development along the edges of major public spaces should enhance their prominence. Where opportunity exists to develop additional large public spaces, design decisions should be based on the place of the park within the overall context of the city, on their relationship to adjacent buildings, on intended uses, and on ease of maintenance.

Smaller outdoor spaces off the sidewalk also influence the quality of the streetscape. Spaces within Boston's city blocks can provide a range of publicly- and privately-owned amenities with varying degrees of physical and visual access from the sidewalk. The courtyard of old City Hall, the Boston Five Park, and Post Office Square Park (Angell Memorial Plaza) are representative of the range of successful small open spaces downtown. Opportunities for creating additional small parks will present themselves as development is proposed in Central Boston. In reviewing such proposals, important design considerations will include microclimate, architectural context, the continuity of the street wall, the size and shape of spaces, and the appropriateness of the space to the building. The design of a small space is most successful when it is integral with the overall project

design; when it clarifies the public, semi-public, or private nature of the place; and when it lends a pleasant ambience to the streetscape.

Public and semi-public areas within and atop buildings, such as arcades, porticos, and atriums, are another form of urban open space in Boston. The lobbies of hotels, public buildings, office buildings, and apartment buildings, when designed as extensions of the sidewalk, serve as semi-public, protected meeting places and transition zones between the public street and private rooms. The waiting rooms of South Station; the arcades in Mercantile Wharf, Russia Wharf, and the Old South Building; the art deco lobbies of the United Shoe Machinery Building and the State Street Bank on Federal Street provide such semi-public interiors.

Atriums are proposed for a number of new buildings, including the Government Services Administration Building and Dewey Square Building. The range of spaces could be expanded by increasing the use of rooftops, and by designing interior public spaces to relate to existing pedestrian ways and open spaces. As with outdoor parks and plazas, provision of suitable interior public spaces should be an integral part of the design of new buildings.

Central Boston's urban spaces are most successful when the size, scale, and ambience respond to anticipated users and activities. Careful programming of uses and attention to landscape design are important: in public spaces of all sizes, varying types of uses can be accommodated including vendors, per-

forming artists, organized and informal sports activities, and community events. Where appropriate, these types of uses will be encouraged. The inclusion of art in public spaces has long been a tradition in Boston. Fine art - statuary, sculpture, murals, sidewalk paintings, and environmental art — is accessible to the public on a daily basis, particularly projects located in Urban Renewal projects. Fine art has been included in some other major developments as well, either at the City's request that one percent of the project's cost provide for the public art or because of a developer's own interest in so enhancing a project. The inclusion of art in future development will be a component of the City's design guidelines.

THE PUBLIC ENVIRONMENT

The design and location of Central Boston's buildings and open spaces in combination establish the public environment. The interrelationship of buildings and open spaces affects the microclimate, public safety, and the character of streetscapes. The form of buildings and open spaces can create microclimates at street level which sometimes create adverse impacts from wind and shadows. Negative environmental impacts can be partially mitigated by sensitive building design. Public areas can be protected by awnings, arcades, porticos, and glass coverings while maintaining contact with the out-of-doors and its hourly and seasonal changes. Design guidelines will attempt to ensure that development in Central Boston will minimize negative wind and shadow impacts

without isolating pedestrian activity away from the natural environment. (This is discussed in greater detail in the Environment chapter of this report.)

People's sense of comfort and security is a major factor in their decisions to shop, live, work, or invest in an area. Landscape details and public amenities, such as paving materials, benches, restrooms, and outdoor lighting are some factors which help to determine public safety and comfort. Some factors which make the public environment a convenient and comfortable place, also contribute to public security. All-hours activity in adjacent buildings, street lighting, transparency of storefronts, lack of hidden spaces and dead ends, a clarity of maintenance responsibility for spaces, and distinctions between public, semi-public, and private areas add to the security of the street. Guidelines promoting public safety and comfort will be important in the design and review of developments proposed for Central Boston.

In addition to microclimate, comfort, and security, the designs of new developments can have major influences on the character of the urban environment. One of the ways this can be accomplished is by the addition of interesting landscape features such as overlooks, tunnels, porticos, steps and grade changes, bridges, fountains, dramatic lighting, flags and banners, and environmental art. Building facade design, signage, shops and activity along the sidewalk, special events, and seasonal decorations can add interest to a street and variety to a district. Where appropriate,

design guidelines will encourage developers to include such features in new projects.

CONCLUSION

Decisions made regarding the location and design of buildings and open spaces in combination shape the public environment, determining its aesthetic character and affecting public safety and comfort. Because of the importance of these individual decisions to the quality of the street environment and overall form of the city, guidelines for the design of buildings and public spaces will be a major component of the City's development policies for Central Boston.

CENTRAL BOSTON ON A TIME CONTINUUM

Over time economic, cultural, and technological changes have altered the physical organization of Central Boston and the design of its streetscapes, parks, and buildings. Nonetheless, much of its form is still derived from that of earlier periods. Today the form of Central Boston serves as a collage of time, giving a special character to the city while providing people with reminders of the past and a sense of continuity. Maintaining these attributes as development takes place and providing the flexibility to respond to future needs and opportunities are important goals of the development strategy for Central Boston.

CONSERVATION OF HISTORICAL RESOURCES

Boston's architectural and topographical legacy is a critical

factor in people's decisions to live, work, and invest in Central Boston. Many issues to be addressed in formulating design policies center on protecting and enhancing the city's historical resources. A number of these issues are referred to elsewhere in this chapter, but because of the importance of historic conservation to the design of Central Boston, they are given special consideration here.

Boston's reputation as an historic city with a rich tradition and heritage has resulted from the unique combination of architecturally significant buildings of all eras, neighborhoods and districts that have evolved over several centuries, and its special street patterns, urban parks, and plazas. These are valuable assets. They represent an investment in labor, materials, and craftsmanship; are reminders of the processes, values, and ethnic contributions which have shaped Central Boston; and give a sense of identity and stability to Boston.

Throughout the decades, construction has added buildings to suit changing needs and styles, many of them designed in a manner compatible with the existing scale and character of the city. Preservation, rehabilitation, and adaptive re-use of distinctive structures has continued alongside new construction, often providing space more economically and quickly than new construction. Rehabilitated structures house institutions, such as the Institute of Contemporary Art and the Children's Museum, and help to restore or maintain the historic integrity of their surroundings.

The conservation of Central

Boston's historical resources takes several forms. Some historic buildings have been meticulously preserved, such as the Harrison Otis House, and stand as museums of a particular point in time. Other buildings and districts, such as One Winthrop Square, Charlestown Navy Yard, and Faneuil Hall Marketplace, have been rehabilitated to maintain the scale and structure of the past, while introducing elements which suit current needs and tastes. Preservation development has successfully merged single large new buildings, such as the Bostonian Hotel, with existing structures. These various options allow for both preserving quintessential landmarks and for knitting together the old and the new to adapt to growth and change.

However, some development has led to the demolition of historically and architecturally significant buildings, as well as whole districts of the city. Inappropriate new construction has sometimes had a negative impact on the historic character of Boston, and many notable buildings have been insensitively altered or enlarged. New storefronts in particular have often failed to acknowledge the overall design of the building. As new development continues in Central Boston, issues are raised concerning what buildings, districts, streets, and open spaces should be preserved, how they should be preserved, and how new development should be integrated with the existing city fabric.

Determining how to achieve a reasonable balance between conservation and development and how to protect the environs

of notable public resources, such as Boston Common and Boston Public Garden, are goals of the development strategy. Guidelines can help to identify ways to successfully blend new, large structures with the city's traditional urban fabric, and to minimize the negative impacts of development of valuable resources. In coordination with the work of the Boston Landmarks Commission, the development strategy and guidelines will promote the conservation of Central Boston's architectural resources and historic character and the successful commingling of new and existing forms.

ANTICIPATION OF CHANGE

Managing the effects of growth, the purpose of the Central Boston Development Study, includes anticipating change. While forecasts of economic growth gives some indication of how much development might be expected, unpredictable forces, cultural trends, and new technologies will lead to alterations in Central Boston's urban design. The City cannot foresee the future, but it can strive to maintain a physical framework capable of adapting to future needs and opportunities while preserving Central Boston's rich and complex form.

Determining the location and scale of new projects is a significant component of managing urban growth. In the past, the scale determined by building technology, the pattern of multiple buildings per block, and dependency on natural air and light controlled the size of structures and led to incremental growth and change. Today, development takes place under a different set of constraints and

opportunities. New building technologies and real estate economics foster the construction of large structures, rather than incremental development. Although the City carefully considers the impacts of proposed buildings that come under its review, it has become increasingly important in a time of substantial growth and change for the City to provide an overall framework for development decisions.

The goal of the urban design strategy and guidelines for Central Boston will be to provide a framework for individual enterprise and creativity which benefits the urban design, public environment, and quality of life in Boston. The planning process will explore how development can assist in better organizing the city, enhancing the urban geography, improving circulation networks, and strengthening districts. The process will determine how to guide the design and location of buildings and open spaces in ways which enhance the existing scale and character of parts of Central Boston and protect significant historical resources.

The development strategy and guidelines for Central Boston will reflect an image of the future of the city as determined by the individuals, community groups, business people, and government agencies who participate in the open planning process. The urban design policies for Central Boston that are formulated in that process will help to continue producing a city with a unique ambience and human scale, a city convenient and attractive to businesses, residents, and visitors.



Introduction

The quality of the urban environment is determined by some of its immeasurable aspects, such as the aesthetics of urban form, the scale and design of structures, and the location of open space. Other elements which contribute to the quality of the environment are often less visible than the design of the city, but are measurable and directly correlate with the public health and the condition of Boston's natural resources. Environmental quality, the use of energy, and the capacity of the infrastructure are thus important considerations in the City's development policies.

New development can measurably affect Boston's environment, energy, and infrastructure depending on how traffic patterns, the location and design of buildings, and construction activity itself are controlled. Inadequate controls on the impacts of new development can degrade the city's environment and inhibit the city's ability to get Federal funds which have supported some of Boston's development, and transportation and park improvements in the past.

But urban growth presents opportunities to protect and enhance the quality of the environment as well. The City, through its review of development proposals and through the coordination of its efforts with Federal, State, and regional agencies, already has mechanisms in place which regulate environmental quality. Strategies and guidelines developed through this study will further assist in the City's efforts to enhance the quality of Boston's environment.

This chapter of the report is comprised of three sections. The first deals with the impacts of development on the city's environmental quality: its air, water, and microclimate (the

conditions of wind, sun, and noise in small-scale locations about the city). The second section of this chapter is concerned with the conditions of Boston's infrastructure: its transportation, water, and sewerage systems. The third describes the impacts of new development on the production and supply of energy. The background information contained in each section will help in formulating development policies respectful of the city's environmental quality.

AIR QUALITY

The air quality in Boston is affected by a number of factors related to development: traffic levels, the height and location of buildings, construction activity, energy production, and industrial processes. The Federal government has set standards for air quality and regulates some activities which can adversely affect the environment. However, other impacts need to be controlled by state and local governments. Through its development guidelines, the City will further its efforts to minimize air pollution in Boston.

The Federal air pollution regulations establish national ambient standards for seven pollutants. Metropolitan Boston, an air quality region, is classified as in "non-attainment" for three of these standards: carbon monoxide, hydrocarbon, and ozone levels are high.

Some factors which contribute to these unacceptable levels have originated within the city and the region. Transportation sources generate most of the carbon monoxide and hydrocarbons in the air; energy production, incinerators, construction and demolition and to a lesser extent, transportation sources generate particulates. Ozone, which travels with the prevailing winds, originates outside of Massachusetts.

Because many of the elements which pollute can be controlled locally, the City is in a position to minimize the adverse impacts of new development on Boston's air quality. Factors which the City will continue to address through its development policies include traffic impacts, the loca-

tion of development, energy production, and industrial processes.

IMPACTS OF DEVELOPMENT

• Traffic Impacts

Carbon monoxide, hydrocarbons, nitrogen oxides, and lead are major polluting by-products of automobile combustion. Traffic generates seventy percent of the hydrocarbon emissions and approximately ninety percent of the carbon monoxide emissions in Boston. Vehicular pollution is exacerbated by traffic congestion. When vehicles are running at low speeds or idling, their emissions are greater than at times of smooth traffic flow.

Carbon monoxide levels, because they are easily affected by the location and geometry of an area, are sensitive to new development. Narrow streets, flanked by tall buildings, trap pollutants between buildings and impede dispersion. In Boston, sea breezes help to disperse the concentration of air pollutants downtown. This makes it especially important to encourage the location of new tall buildings to sites where they will not adversely affect the normal air flow. The temporary accumulation of high concentrations of carbon monoxide, or "hot spots", occurs where traffic is most congested. Measurements taken at five major downtown intersections indicate the presence of such a phenomenon; the eight-hour carbon monoxide Federal ambient standards are commonly exceeded at the sites. "Hot spots" also occur frequently in the vicinity of parking garages, due to idling of

engines as cars queue at the entrances of the facilities. The Boston Redevelopment Authority, with a grant from the U.S. Environmental Protection Agency (EPA), is conducting a study to determine how to reduce air pollution in such locations.

Though its transportation policies, described in detail in the transportation section of this report, the City has already taken steps to reduce traffic congestion, and new strategies are being planned to further the effort toward meeting the carbon monoxide one hour primary standard of thirty-five parts per million.

• Construction Impacts

Construction activities are prime sources of particulate pollution downtown. Building demolition, land clearance and excavation, exposed aggregate storage piles, and the transport of debris and fill generate dust and increase the particulate levels.

Emissions from construction and land preparation activities depend on such factors as soil characteristics, meteorological variables, and construction practices employed. Because these pollutants are not vented or discharged through a stack, or point source, they are referred to as "fugitive emissions." The EPA calculates that fugitive dust pollution from land clearance and excavation activities can equal four pounds per cubic yard. When combined with Boston's background level which measures up to 150 micrograms per cubic meter in some locations, the pollution from construction can exacerbate the ex-

isting particulate problem. Continually spraying a site with water or other appropriate chemicals, and covering debris and fill in transit and in storage, would minimize particulate levels generated by construction.

Asbestos in older buildings slated for demolition is hazardous to air quality and public health. Asbestos, once used for insulation and fire-proofing, may be a carcinogen. Asbestos particles can become airborne unless removed with caution prior to building demolition. Control of asbestos is regulated by the Boston Air Pollution Control Commission through its regulation on abrasive blasting and by the U.S. Environmental Protection Agency through a prohibition on asbestos in new construction.

- Impacts of Energy Production

With the rising costs of producing energy with Boston Edison Company's old system, some commercial customers have switched to private fuel-burning systems which have the potential to increase air pollution.

Because of the rising cost and supply problems associated with other fossil fuels, existing facilities may be converted to coal and new coal-fired plants built to generate energy for less money. New sources may increase air pollution. The U.S. Department of Energy has begun a program to convert existing energy facilities to coal-burning plants, and seven are proposed for Massachusetts. Such conversions, coupled with higher sulfur fuel variances, might increase sulfur dioxide and particulates

within the Commonwealth to unacceptable levels.

Proposed Federal regulations favoring cogeneration projects could result in the installation of large diesel or gas turbine-powered generators in Central Boston. Although cogeneration facilities reduce total fuel consumption and pollution by utilizing waste heat, they also change the nature, location and type of pollution generated. The change in type of pollution from these facilities is difficult to quantify, as is the cumulative effect upon air quality standards.

- Industrial Impacts

Industrial development in Central Boston generates little air pollution, although the State inventory of air pollution sources identified twelve major hydrocarbon sources within Boston, each contributing in excess of one hundred tons annually. Industrial processes emitting hydrocarbons in Boston include coating operations, gasoline storage facilities, degreasers, dry cleaners, graphics and printing operations, and ship repair and maintenance. (Table 1 in the Environmental Appendices summarizes stationary sources of hydrocarbon emissions within the Boston area.)

REGULATORY CONTROLS AND POLICIES

New and existing sources of air pollution are regulated under the Federal Clean Air Act, and State and City ordinances. Under these regulations, sources must meet emission limitations within a specified deadline. New development must conform with

new source standards and offset new pollution levels through reductions in emissions of existing sources. Depending on the City's ability to curb existing pollution sources, additional controls on existing and new pollution sources throughout the Boston area may eventually be necessary to meet attainment deadlines. Described below are the applicable Federal, State, and City requirements; the Federal and State ambient air quality standards are listed in Table 2 of the Environmental Appendices.

Under the Federal Clean Air Act, EPA established national ambient air quality standards for seven pollutants. Primary and secondary standards have been established for these pollutants. The State's pollution control regulations incorporate the Federal ambient standards.

Under the Act, the State should have met the standards for each pollutant by December 1982. Because of the difficulty in meeting auto-related carbon monoxide and hydrocarbon standards, Massachusetts received an extension until 1987. The State Implementation Plan outlines the measures necessary to meet the standards and provides an annual margin for "reasonable further progress" towards attainment of the standards. The Massachusetts State Implementation Plan was conditionally approved by EPA last fall. Final approval of the plan is dependent upon receipt of additional information on small sources and demonstration of "reasonable further progress" within the greater Boston area.

Recognizing the varied

sources of air pollution, Massachusetts' State Implementation Plan incorporates controls on both mobile and stationary sources. The transportation portion of the plan includes a vehicle inspection/maintenance program designed to insure maximum ongoing efficiency of automotive pollution control devices; improved mass transit program to encourage greater ridership and less dependence upon private automobiles; implementation of road improvements to reduce congestion; and a commercial off-street parking freeze for downtown Boston and for Logan Airport. The inspection/maintenance program went into effect in April 1983, and it is expected to help Boston reach carbon monoxide and hydrocarbon standards by 1987.

To accommodate new stationary sources, the Implementation Plan incorporates stringent controls on existing sources, as well as an emission offset growth policy for new development. Under the plan, existing sources must utilize reasonably available control technology (RACT), that is, a minimal level of control taking into account economic and technology considerations. Reductions from existing sources must annually demonstrate reasonable progress towards meeting standards.

In response to EPA's policy of restricting major new or modified stationary sources in nonattainment areas, the State adopted an emission offset policy. Under such a policy, projects which would increase already excessive levels of pollutants, according to Federal standards, must control emis-

sions to the greatest degree possible. New sources are required to utilize "lowest achievable emission rate technology" (LAER) established by the State as either the lowest level contained in the implementation plan of any state, unless the permit applicant can demonstrate that such a level cannot be achieved; or the lowest emission level which is achieved in practice within a relevant industrial category.

Major new sources of one hundred tons or more must more than offset their emissions through reductions obtained from existing sources, as well as demonstrate that they will not adversely affect progress towards achievement of standards within the air quality region. Major Boston hydrocarbon sources affected by the regulation include printing and publishing; dry cleaning; ship repair; and coating operations.

If standards are still exceeded, the State will need to develop further restrictions on major new sources, and new controls on smaller, unregulated sources.

The Boston Air Pollution Control Commission (BAPCC) is the local agency responsible for adoption and enforcement of the municipal air pollution control ordinance. The Commission, comprised of five members appointed by the Mayor, regulates pollutant emissions within municipal boundaries. Regulations adopted by the Commission must, at a minimum, be as stringent as State regulations, and must be approved for consistency with State regulations. The Commission is empowered

by the City to regulate fuel burning activities, open burning, abrasive blasting, and the commercial parking freeze. The sulfur content of coal and residual oil, as well as opacity particulate levels, are regulated by the ordinance.

The BAPCC exercises some control over development in Central Boston in several ways. One way BAPCC controls the impacts of development is through its stringent regulations on particulate pollution that renovation projects can generate. The regulations require blasting activities to be completely enclosed, and all loose materials attributable to the blasting to be removed; and they prohibit the use of materials containing free silica or re-used abrasives. Second, BAPCC controls development less directly by the off-street commercial parking freeze which it manages. (The freeze is described in greater detail in the Transportation section of this report).

A third mechanism, the Controlled Trading Program, was established under the Clean Air Act in order to provide incentives for improving air quality without restricting economic growth. This program serves several functions: it allows plant officials to determine the most cost-effective means of meeting air pollution standards; it builds in a pollution margin for new growth; and it minimizes regulatory review.

The Controlled Trading Program is applicable to both new and existing development. Developers seeking to locate in nonattainment areas can use the

program to build in a growth margin for additional development. By reducing pollutants beyond what is currently required, developers can credit the surplus reductions for future growth.

The Controlled Trading Program also offers existing firms an innovative way of meeting air pollution regulations. Under the program, firms determine the most cost-efficient means of meeting standards within their own facilities. Rather than requiring that each point source meet a particular emission limitation, firms can determine the mix of controlled sources, provided the aggregate emission level does not exceed the permitted level for the entire facility.

To assist new developments, the BRA plans to develop an emission reduction credit bank. Banked reductions would include those generated from reductions at City facilities; those conveyed to the City; and those received from facility shutdowns. Applicants can petition for use of these banked reduction credits to offset emissions from new development. Priority will be given to those projects which reinforce the City's development policies.

In addition to the regulatory controls in place at the Federal, State and City levels, other development policies could help to reduce air pollution. Well-sited parks and open space, as noted previously, can improve air flow and disperse pollutants. Vegetation within the parks is capable of absorbing dust and pollutants. Trees cut down on dust in the air through the filtering effect of their foliage and needles. Development guidelines promoting new ways, such as the

above, to improve air quality can minimize the adverse impacts of urban growth and help Boston to achieve State and Federal air quality standards.

WATER QUALITY

Both Boston Inner Harbor and the Charles River Basin add a dimension to Boston that only a few other cities in the country can duplicate. Historically, the Inner Harbor has helped to strengthen the local economy, serving the needs of fishing, manufacturing, and other commercial sectors. Both bodies of water enhance the aesthetic appeal of the city and provide recreational opportunities for residents and visitors. Poor water quality can threaten these assets.

The City, the Metropolitan Area Planning Council (MAPC), the Metropolitan District Commission (MDC), Federal and State agencies have taken steps to improve the quality of water in metropolitan Boston. Their actions have already led to improvements in the Inner Harbor and the Basin, but it will take time and additional efforts to bring the quality of the Commonwealth's water quality up to acceptable levels.

Boston Inner Harbor and the Charles River Basin currently do not meet the Massachusetts' water quality standards, which set acceptable levels for various water uses. (The standards and criteria for the Basin and Inner Harbor are included in Table 3 of the Environmental Appendices.)

Combined sewer overflows (CSO) are the most significant source of pollution in the Inner

Harbor. Fifty-one CSOs there have led to dissolved oxygen levels (one of the most important indicators of water quality) which are considerably lower than the prescribed level. A low level of dissolved oxygen makes the water unsuitable for many forms of fish.

Although CSOs are the most significant source of pollution in this water body; surface oils, floating debris, and odors also detract from the Harbor and shorefront. Heavy metals, another source of pollution, are found in high concentrations.

The Army Corps of Engineers has proposed removing floatable debris and dilapidated structures from Boston Harbor, but negotiations over who will bear the cost have delayed implementation.

Sludge from the Deer and Nut Islands sewerage treatment facilities also pollutes the Harbor. The current status of progress toward eliminating this pollution is addressed in conjunction with the discussion of the sewer system serving the downtown area.

The Charles River Basin is polluted by CSOs and salt water intrusion. The latter inhibits vertical mixing, causing a stagnant, dense bottom layer of water devoid of life and low in dissolved oxygen. A pungent sulfur odor emanates from the Basin as a consequence. Several of the water quality parameters in the Basin are in violation of the State criteria, and there are also high concentrations of heavy metals and sediments in the water. Improvement of water quality in the Basin through elimination of CSOs and the stagnant bottom layer of water

has already begun to enhance this segment of the River. (The Environmental Appendices, Tables 4-7, contain more detailed information on the water quality of the Basin and the Inner Harbor.)

To expand the usable land area of Boston between the 1700s to the present, the City has periodically filled areas of Boston Harbor and the low lying marsh areas and alluvial plains in the Back Bay. New land created in this manner includes parts of South Boston and East Boston, Logan Airport and Bird Island Flats, and the Back Bay. Land fill has increased the City's mass to more than three times its original size. If this practice is continued, large fill operations and the cumulative impacts of minor ones could reduce Boston Harbor's value as a unique natural resource and diminish its aesthetic and economic importance to the city. When proposals are for non-maritime uses — such as those for parking, office, hotel, residential, or roadway construction — there is little justification for altering Boston Harbor.

Development on land fill in the Back Bay has caused some structural damage to buildings. The construction of sewer lines and subway tunnels have lowered the ground water level. The lowered water table has exposed the pilings supporting older buildings. Unless the water table is maintained at five feet or higher, the pilings quickly rot. Recent structural problems have occurred at the Advent Church, the Union Boat Club, and several Beacon Hill residences. Also, the compaction of

fill and the uneven settling of the earth has caused some structural damage to buildings, though this is now a less serious issue.

Modern engineering practices through contract specifications and the building permit process address the lowering of water table at specific project sites. However, no controls exist that consider the cumulative widespread effect. The Greater Boston Chamber of Commerce is initiating a study to determine the causes, effects of this problem and possible solutions to it. A public and private task force will form to help implement appropriate solutions.

REGULATORY CONTROLS AND POLICIES

Regulations and policies to control water quality exist at all levels of government, but the primary legislation governing water quality is the Federal Water Pollution Control Act of 1972 Amendments, which amended the 1965 Act. In response to Federal legislation, Massachusetts established the Massachusetts Clean Waters Act and Massachusetts Water Quality Standards, and the Metropolitan Area Planning Council established a Water Quality Management Plan for Metropolitan Boston. The plan established an intergovernmental committee to coordinate and expedite action on the various wastewater management projects planned for Boston Harbor.

The City has input into water quality planning for the Harbor through MAPC and through the Boston Water and Sewer Commission; both are members of

the committee.

The Federal legislation also provides for funding of seventy-five percent of the costs of the planning, design, and construction of publicly-owned wastewater treatment facilities. This provision specifies a number of conditions, including a requirement that the agency operating the facility develop a system of user charges based on the proportional wastewater volume of each user. As a result, the MDC is developing a pretreatment program (point source control) and a system of user charges, and has built facilities described in the Sewerage section of this chapter. All of these strategies will help to reduce pollution in Boston Harbor and the Charles River Basin.

Other Federal legislation established the National Pollutant Discharge Elimination System (NPDES) which limits the amount and nature of effluent to be discharged into the nation's waters. All municipal treatment plants and all industries discharging directly into waterbodies are required to obtain a NPDES permit, specifying the type and quantity of effluent the facility may discharge. This permit system is administered by the Commonwealth for EPA. While point source control does involve greater expenditure for an industry, the NPDES requirements are nationwide and therefore do not place Boston at any disadvantage in terms of industrial development.

The National Environmental Policy Act (NEPA) and the Massachusetts Environmental Policy Act (MEPA) provide indirect control over water quality.

Under NEPA, Federal agencies must consider the environmental consequences of a proposed Federal action. For major projects, the principal mechanism for this analysis is the Environmental Impact Statement process. Both the issuance of NPDES permits for new sources and grants for construction of treatment facilities are subject to review under NEPA. Under MEPA, projects undertaken or financially assisted by the State, or for which permits are issued by a State agency, must minimize adverse impacts on the environment. The principal means of evaluating the potential for impact is the Environmental Impact Report process.

In accordance with its Wetlands Protection Act, Massachusetts established regulations stipulating that no person shall remove, fill, dredge or alter any bank, fresh water wetland, coastal wetland, any land under the water, or any land subject to tidal or coastal storm flooding without receiving and complying with an Order of Conditions issued under these regulations. In Boston these regulations are administered by the Boston Conservation Commission. The Commission may deny a permit for construction, or stipulate through an Order of Conditions controls which must be implemented. If a permit is denied, the proponent may appeal to the State's Department of Environmental Quality Engineering (DEQE). Provisions of the Wetlands regulations apply to any activity within one hundred feet of any coastal or inland wetland feature or within one hundred feet from the elevation

of the one hundred year flood.

Construction in marine coastal areas is also regulated by DEQE through issuance of Waterways Licenses. The licensing regulations were established in order to protect the public rights of fishing, fowling, and navigation and all rights in the Commonwealth tidelands under DEQE jurisdiction. The Army Corps of Engineers also must issue a permit for construction, dredging, or alteration in navigable waters, based on protection of the public's interest and rights in these waters.

In formulating new policies and strategies to improve water quality, several management practices and treatment methods exist for controlling CSO pollution and are listed in Table 8 of the Environmental Appendices.

The on-going of Federal and State regulations and work being conducted at both the regional and local level are helping to improve water quality. Central Boston development strategies and guidelines can assist in the effort by ensuring that new development does not further pollute the city's water resources.

WIND, SHADOW, AND NOISE: DEVELOPMENT IMPACTS ON THE MICROCLIMATE

NOISE

In urban environments, daily transportation, commercial, and industrial activities all generate background, or ambient noise. Occasional activity, such as air traffic and construction work, create intermittent and louder noise. Ambient noise levels have increased in some downtown areas which has created the

need to control activities generating noise, or to design buildings to mitigate the impacts of unavoidably noisy activities. Intermittent noise from such activity can be extreme: a single diesel truck, heard from fifty feet away, emits noise approaching 90 dB (A), and a pile-driver heard from the same distance, can be as loud as 100 dB (A). (Noise levels are measured in decibels on an "A" weighted scale — db(A) — a convention which compensates for variations in the human perception of noise.)

It is possible to control noise and to set standards for acceptable levels of noise. Though tolerance for noise varies amongst individuals, the U.S. Environmental Protection Agency has defined certain levels as requisite for protecting public health. Seventy dB (A), averaged over twenty-four hours, should not be exceeded in order to guard against hearing loss. Exposure to noise levels in excess of 90 dB (A) for even eight hours a day will cause significant hearing damage; levels greater than 110 dB (A) can lead to permanent damage or loss of hearing. Consequently, increased frequency and duration of activities generating loud noises are potentially harmful to urban dwellers.

Noise levels measured in some parts of Central Boston exceed Federal standards, but remedies are possible, as changes at Downtown Crossing illustrate. The City designated the Crossing as an auto-restricted zone, and a noise sampling program was conducted to measure the change before and after the restriction

was imposed. On Winter Street the maximum one-hour level decreased from 83 to 76 dB (A) between 1978 and 1980, and the average weekday level dropped by three decibels.

REGULATORY CONTROLS AND POLICIES

The Boston Air Pollution Control Commission's enforcement authority and the City's noise regulations are the most effective mechanisms that the City has for controlling noise emissions. The Boston Air Pollution Control Commission has adopted Regulations for the Control of Noise in the City of Boston which restrict noise according to standards set for residential, residential/industrial, business, and industrial zoning districts. In a residential zone, the maximum noise level may not exceed sixty dB (A) during the day and fifty dB (A) at night, and in an industrial zone, the least restricted zone, the maximum may not exceed seventy dB (A) at any time. Exceptions are indicated for construction, but these levels also are restricted to maxima according to zoning districts.

The Federal Noise Control Act of 1972 provides for a division of powers amongst the various levels of government. The primary Federal responsibility is for noise source emission control; the State and other political subdivisions retain the rights and authority to control the use of noise sources and to set the permissible noise levels.

Criteria developed by the Environmental Protection Agency (EPA) provide assistance to state and local governments in imple-

menting the requirements of the Federal Noise Control Act. (These criteria are listed in Table 9 of the Environmental Appendices.) The U.S. Department of Housing and Urban Development (HUD) has established Environmental Criteria and Standards for acceptability of HUD-supported projects and has established necessary mitigation measures for new or substantially rehabilitated construction. The U.S. Department of Transportation Federal Highway Administration (FHWA) has promulgated Noise Standards and Procedures for use by state highway agencies and by FHWA in the planning and design of highways and determining noise abatement measures for traffic-related noise. Federal agencies implement noise standards through the State's Environmental Impact Report and Federal Environmental Impact Statements required for certain development proposals.

The BRA has worked closely with the Massachusetts Executive Office of Environmental Affairs to reduce noise levels generated by operations at Logan Airport, primarily by prohibiting the use of Logan's facilities by aircraft that violate Federal noise emissions standards. Massport bases its air traffic patterns in part on noise considerations and has implemented several other noise abatement procedures.

Federal noise standards, administered by Federal and State agencies through the environmental review process, along with the regulations of BAPCC, help to control the adverse impacts of new construction on the City of Boston.

WIND

Boston is a windy city with an average annual wind speed of 13.3 miles per hour. Winds from the southwest through northwest hit the city approximately half of the year; winds from the southeast are less frequent, occurring only 2.5 percent of the year. Average monthly wind speeds range from 10.9 miles per hour in July and August, to 14.4 miles per hour in January and February. Gale winds of thirty-two miles per hour or higher are expected at least one day each month, and gales are both more frequent and severe in the winter months¹.

The presence of tall buildings can increase wind velocities, affecting the microclimate along adjacent streets and sidewalks. This is because wind velocities increase proportionately with altitude. The higher wind velocities exert pressure which deflects the high winds near the top of a building downward. Consequently, wind velocities at the base of a tall building can be twice as great as the free flow, ground level winds. The wind dynamics become more complicated when tall buildings are close together. Eddies and turbulence occur between the buildings, and speeds are increased by the tunneling effect.

It is possible to minimize the adverse effects of tall buildings on ground level wind conditions. Solutions to wind problems in some cities have included architectural modifications, canopies, and vegetative or rigid wind barriers. Other methods — prohibiting pedestrians from high wind areas or installing safety warnings — do not remove the

problem and are unacceptable solutions for Boston. Appropriate changes at the design phase involve altering a building's proposed massing (its height, width, and shape) or changing its orientation. Add-on architectural solutions may include enclosed arcades and open canopies; landscaping solutions include wind screens such as rigid walls, fencing, or tree plantings.

To determine pedestrian wind conditions expected from a proposed construction project, wind tunnel testing is conducted. The tunnel simulates the interaction between the built environment and statistically predicted wind directions and velocities throughout the year. The simulation can also test the efficiency of proposed design modifications.

Prior to testing and to proposing modifications, standards are needed to describe what velocities are acceptable for pedestrian comfort and safety. Researchers in the United States, Canada, and Great Britain generally agree that an effective gust speed of thirty-one miles per hour, greater than one percent of the time, is the threshold above which people begin to find the wind environment unacceptable and dangerous.

REGULATORY CONTROLS AND POLICIES

Currently, Federal and State environmental agencies have established no numeric regulatory standards for maximum permissible wind velocities. Wind impact analyses can be required, however, through the Environmental Impact Statement and

Report processes. The National Environmental Policy Act implies that wind impacts be considered in the review of Federal or Federally-funded construction projects.

The Massachusetts Environmental Policy Act (MEPA) specifically includes consideration of wind impacts in its implementation regulations.

The City of Boston currently requires wind tunnel testing for proposed projects which could have severe impacts on the microclimate.

(Notes 2 and 3 following this chapter, and Tables 9 and 10 in the Environmental Appendices provide more detailed information on setting standards for acceptable wind conditions. The information will serve as a basis for policy formulation.)

SUNLIGHT AND SHADOW

Shadows cast by tall buildings vary with building height, time of day, and seasonal angles of the sun. Although modeling can illustrate the shadow effects accurately, models tell nothing about the impacts of those shadows. Impacts can seem most significant on warm days when workers, shoppers, and visitors want to enjoy downtown open spaces, as well as on winter days when the warmth of the sun is especially welcome.

Shadows, in addition to reducing the attractiveness of the city's streets and parks, can thwart efforts to promote solar energy. With increasing concern over fossil fuel shortages, urban residents have become more interested in solar alternatives. In Boston there are passive solar greenhouses atop residential

buildings, and the sun warms glass-enclosed public spaces in winter. In the Fenway solar collectors heat an apartment building on a densely-settled street. Generally, solar technology has improved and become less costly but at a time when new development might diminish access to sunlight.

REGULATORY CONTROLS AND POLICIES

It is the City of Boston's practice to preserve access to sunlight in sensitive areas and to work with developers to mitigate the impact of building shadows. Other cities, such as Seattle and New York, have similar goals, supported by ordinances governing shadow impacts.

However, neither the City, the State, nor the Federal governments has established specific regulations for shadow impacts or access to sunlight. The review of shadow impacts from proposed development occurs in cases where the City has design review authority: projects seeking 121A status, zoning variances, or proposals for Planned Development Areas. Shadow impact analyses can be required through the Environmental Impact Statement and Report processes, but only for those projects that trigger the State or Federal review program. The National Environmental Policy Act (NEPA) implies that Federal agencies should consider the shadow impacts of development. The Massachusetts Environmental Policy Act (MEPA) specifically includes consideration of shadow impacts in its implementing regulations. Central Boston's development strategy and

guidelines can add to existing mechanisms for controlling shadow impacts and thus can enhance the public environment of Boston's downtown.

The effective gust speed is technically defined as $U_{eff} = U + k O_m$, where O_m = root-mean-square value of the wind speed fluctuations and k is a constant. Wind dynamic researchers N. Isyumov and A.G. Davenport have suggested the value of 1.5 for k since this value makes U_{eff} in the urban environment roughly equivalent to the mean hourly speed in more open areas to which the Beaufort wind scale refers.

A third measurement of wind speed is the peak gust speed, U , which will occur a few seconds out of every five minutes during which a particular wind condition exists. In general, the peak gust speed will be about two times the mean speed, and the effective gust speed will be about 1.5 times the mean wind velocity.

3. The Beaufort Wind Scale, developed in 1805, provides a descriptive and numeric representation of the effect of wind and the environment. The original Beaufort Scale was developed to reflect average wind speeds at a reference height of 10 meters (approximately 30 feet) in an open, rural setting. Table 10 of the Environmental Appendices is based on this scale but is adjusted downward by about 20 percent to reflect wind speeds at the pedestrian level. In an urban setting the mean wind speed is generally lower than in rural areas, although the gustiness is

greater due to the interaction of the wind with buildings. Because of this urban effect, the adjusted wind speeds in Table 10 are considered to approximate the effective gust speed, U_{eff} .

designers. These criteria are presented in Table 11 of the Environmental Appendices. The mean wind speeds also have been modified here to indicate the corresponding effective gust speeds. Interpolating to determine an acceptable gust speed at a one percent frequency, a value for U_{eff} of 30.5 miles per hour was the speed above which the wind would not be acceptable.

NOTES:

1. Wind conditions can be defined in several ways. However, when assessing the effects of pedestrian level winds, it is desirable to characterize the wind velocities by a single numeric criterion that can be computed to pedestrian conformity and safety criteria. The wind can be measured as a mean speed, U , or an average of wind speeds recorded over a certain period of time, usually one hour. It can also be characterized by its effective gust speed, U_{eff} .

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Although people's tolerance for wind vary, several researchers have developed wind guidelines for the comfort and safety of pedestrians. These guidelines are based primarily on the Beaufort Scale. Cohen, H. et al., ("Pedestrians and Wind in the Urban Environment", University of Massachusetts Institute for Man and the Environment, UMass/IME/R-77/13, 1977) examined the effects of wind on pedestrians in criteria to guide Boston and has suggested for urban



TRANSPORTATION

More people are moving about Boston than ever before and with the growth of downtown, the number of people driving, walking, biking, riding the T, and moving goods within and around Central Boston will increase in the coming decade. The linkage between development and the need for expanding the capacity of the City's transportation system has been an important consideration for both the City and the Commonwealth.

The Boston area has led the nation in development of innovative transportation policy. The landmark Boston Transportation Planning Review (BTPR), created in 1970, was established to re-evaluate existing plans and policies and to provide the basis for a regional transportation program. The principal policy determination made as a result of BTPR, was that no new expressways within Route 128 would be built. Because additional expressways would create negative impacts, BTPR policies encouraged alternative improvements to the transportation system. The policies, reinforced by Federal, State, and local policies and programs, emphasize regional transit improvements, discourage highway expansion, and limit traffic entering downtown by restricting parking.

Strategies to mitigate congestion and environmental degradation should not inhibit access to Central Boston, discouraging future development. Rather, as more development takes place, strategies should maximize the ways in which new projects can enhance the transportation sys-

tem and minimize the adverse affects of urban growth.

The basic objectives of the City's current transportation policies for Central Boston are to:

- a) reduce the number of vehicles entering downtown, particularly during peak hours;
- b) promote the use of public transportation, bicycles, and higher occupancy vehicles;
- c) avoid conflicts between different transportation modes; and
- d) separate through trips from trips destined for downtown.

The City attempts to achieve these objectives in part through the BRA's review of development proposals. In its review, the BRA evaluates a proposal's potential impact on vehicular traffic and parking, public transportation, and pedestrian and goods movement.

CURRENT STATUS AND ISSUES

• Vehicular Traffic and Parking

As the City continues to develop transportation strategies, it faces a system that is already congested. The most recent extensive survey of automobile travel into the downtown area was taken in 1977 for the Central Artery Study.¹ That study estimated that on an average weekday, there were 450,000 trips through the zone inside of Berkeley Street. Over one-third of the trips were destined for the Central Business District, and during the peak morning hours about one-third of the commuters travel by car. Even a decade ago, the highway system was operating at more than capacity during rush hours.

Since then, traffic volume has grown by over one percent annually. The Massachusetts Department of Public Works estimates that it will continue to grow, at 0.05 percent annually, for the next twenty years.

Travel during peak commuting hours can be frustrating. Although traffic will never flow as smoothly at rush hour as it does at less crowded times, conditions could improve with localized or large-scale modifications. Staggering work hours, increasing the number of car pools (average car occupancy downtown is only 1.4 persons), and promoting the use of public transit could expand the capacity of the system without dramatic changes to the transportation infrastructure. New development, though it generates additional traffic, often provides opportunities to improve the roadway system because of demolition required for projects. Street realignment, changes in curb cuts, sidewalk widening, and street discontinuances are the types of improvements made possible by new development.

Large-scale changes to the transportation system are currently under study. The Third Harbor Crossing and depression of the Central Artery are two major projects proposed to improve the most congested section of roadway in the metropolitan area. The Third Harbor Crossing project would divert traffic destined for Logan Airport and the North Shore from the Artery to a new tunnel. The project to depress the Artery proposes to increase that road's capacity by one-third in each direction, and it would improve

access to the Artery by altering the ramps. Each project could alleviate traffic congestion in Central Boston by 1990. Their costs and impacts are currently under study.

- Truck Traffic

Trucks comprise over five percent of all traffic in Central Boston and slightly more than that in off-peak hours, although the shift from industrial to residential and office land use has reduced truck traffic downtown. Now issues of concern are conflicts between pedestrian and automobile traffic, and trucks unloading on narrow streets. Controlling trucks which carry hazardous cargoes through Central Boston is a serious safety issue.

- Parking Supply

Parking is a limited commodity in Central Boston. There are an estimated 55,000 off-street parking spaces in the area. Approximately 35,000 of these are open to the public; the remaining are spaces reserved for employees, guests, and residents. The number of commercial parking spaces has been restricted since 1973 in an effort to discourage travel by car, to limit the amount of land taken up by parking, and to improve air quality.

- Mass Transit

Public transit is well subscribed to in Central Boston. Six-hour peak ridership into Central Boston is estimated at 365,000 trips. Rapid transit ridership accounts for the majority of the trips; express and local bus and

commuter rail account for a lesser proportion of ridership. Systemwide, MBTA patronage has remained fairly constant since 1975, reversing the decline begun in the early fifties. Private bus patronage has risen sharply over the last several years. The private bus share of the market should continue to expand as parking rates and the time it takes to drive to Central Boston rise. The opening of a bus terminal at South Station in 1985 will also boost private bus ridership.

Most transit lines operate at capacity during the peak hours. Capital improvements underway should improve current conditions and increase ridership. Projects include the extension of the Red Line to Alewife with a two thousand car garage; South west Corridor's new construction between South Cove and Forest Hills; a new Back Bay station for commuter rail and rapid transit; the South Station Transportation Terminal for intercity buses, commuter rail, and rapid transit; platform extensions to accommodate longer trains at stations along the Orange and Red Lines; and the rehabilitation of stations downtown.

Despite all the construction activity, funding for public transit especially for operations, is diminishing. Lack of funds may ultimately result in a reduction in ridership. Because transit currently carries two-thirds of the commuter traffic, transportation and environmental policy on all levels is directed towards expanding the transit market share with whatever sources are available. Maintenance and improve-

ment of the system are critical to attaining these goals.

Locating new development near transit terminals, integrating transit stations into the design of new projects, and improving pedestrian connections between transit stations and the street are all strategies which the City can employ to foster the use of mass transit.

- Pedestrians

Pedestrian volumes in the Central Boston have been growing over the last several years. The Downtown Crossing pedestrian surveys noted entering daytime volumes to be 74,000 in 1978, rising to over 82,000 in 1980. Pedestrian-oriented settings, such as Faneuil Hall Market Place and Downtown Crossing, account for some of the growth.

People living in the inner city neighborhoods — Beacon Hill, Back Bay, the North End, South End, Waterfront, and Charlestown — and walking to work Downtown, also have increased the volume of foot-traffic. Conflicts between pedestrians and vehicular traffic make it difficult to walk about some areas of Central Boston. Some design and location decisions, as noted in the Urban Design chapter, could help to resolve the problem.

REGULATORY CONTROLS AND POLICIES

Because transportation is a regional system, policy extends beyond the local level; Federal, State, and regional agencies also shape Boston's transportation system. The Federal government

funds transportation expenditures in the region; the Metropolitan Planning Organization (MPO) controls the Federal funds. MPO is comprised of representatives from the Commonwealth's Executive Office of Transportation and the Department of Public Works, and representatives from regional bodies — Massachusetts Bay Transit Authority (MBTA), MBTA Advisory Board, Metropolitan Area Planning Council, and Massport. Although the City is not a signatory to MPO, it is involved in the regional transportation planning process through its membership on the Joint Regional Transportation Committee (JRTC), an advisory organization to the MPO, and through its prominent position on the MBTA Advisory Board.

The Urban Mass Transportation Administration (UMTA) evaluates transit proposals and has spent hundreds of millions of dollars on the MBTA system over the past decade to expand service and stem the decline in transit usage. UMTA has also provided the impetus for an auto-restricted zone demonstration project at Downtown Crossing.

Responsibility for various programs and for operating key links in the transportation system falls to state and regional entities. The MBTA's operating decisions — frequency of service, route locations, and hours of operation — as well as its programs to stimulate ridership, affect commuter traffic in Boston. Massport sets toll rates for the Mystic River Bridge and operates port facilities and Logan Airport. The Sumner and

Callahan Tunnels, along with the Turnpike, are operated by the Massachusetts Turnpike Authority. The Commonwealth operates Masspool, a program to encourage the use of van and car pools.

Within the City government, the BRA and the Department of Traffic and Parking share general planning and design responsibilities. The Departments of Police, Fire, and Public Works all set policies pertinent to each department's particular transportation and jurisdictional requirements. In addition, a transportation policy advisor serves on the Mayor's staff. The Public Improvement Commission (PIC) holds final approval authority over proposals to change public rights-of-way. PIC is comprised of the City Commissioners of Traffic and Parking, Public Works, Water and Sewer, Building and Real Property.

Reviewing proposals which affect the transportation system is also shared. Prior to plan submission at PIC, projects are customarily subject to staff review and discussion by the Traffic Liaison Committee, composed of senior staff from Traffic and Parking, BRA Transportation Planning, Fire Department, Public Works, and the Water and Sewer Commission.

Most transportation planning, as noted above, is carried out in accordance with policy, rather than regulations. The City, however, does regulate parking and loading — two aspects of the system which affect new development.

Off-street parking in Central Boston is regulated through the zoning code, administered by

the BRA staff for the Board of Appeal, and the parking freeze, administered by the Boston Air Pollution Control Commission (BAPCC). The coordinated parking policy pursued by these regulatory bodies is to restrict the amount of parking spaces within the core area, thereby discouraging the use of private cars for downtown travel and limiting the amount of downtown land taken up by parking facilities.

Under the current zoning code, parking is now a conditional use in a Restricted Parking District, and approval for any non-residential parking facility within the district must be granted by the Zoning Board of Appeals.

A parking freeze was instituted in 1975, in part to meet the EPA's air quality standards. The freeze set a ceiling on the number of commercial parking spaces within the district shown in Map 10, limiting the number of spaces (35,503) to those in existence on October 15, 1973. To modify or construct new commercial parking facilities in this area, parking operators must have a Parking Freeze Permit. A permit is issued if the proposal adheres to BAPCC regulations and if an equivalent number of off-street or legal on-street parking spaces have been eliminated within the freeze area (and hence spaces are available in a hypothetical parking space "bank").

The freeze applies only to spaces open to the general public where cars are parked for a fee. If the general public is excluded from a facility, for example in resident, guest, or em-



ployee-only parking, an exemption from the freeze can be obtained. The Boston Air Pollution Control Commission is the issuing agency for these permits and exemptions.

While commercial parking is restricted, resident parking is protected by an on-street parking permit system in some parts of Central Boston and through the requirements of the Zoning Code. Developers of new and rehabilitated residential structures and hotels in most parts of Central Boston are required to provide parking on the basis of the number of units and location. Parking may be provided off-site; leasing of nearby spaces is permitted in some instances, with the approval of the Zoning Board of Appeal.

In addition to regulating parking, the Zoning Code requires that off-street loading facilities be included in new projects. This regulation is intended to minimize interference between loading activities and vehicular and pedestrian traffic. The number and length of loading bays required varies with the square footage and the type of building. The impacts of truck traffic are also controlled, by separating truck routes from residential streets and restricting delivery in Downtown Crossing to early morning hours.

The City is reviewing its policies to determine how to accommodate future development, to provide sufficient short-term parking for retail customers while minimizing traffic congestion. The City's "Parking Supply and Demand Study", the first phase of which was recently completed, is a step in that

direction.

The success of existing policies limiting automobile access in Central Boston relies on an efficient transit system. Hence, the City and the MBTA must cooperatively implement transit policy. The following transit policies, applied to recent development projects, are described in the Urban Design chapter of this report: locating major development near transit terminals, integrating terminals into the design of new projects wherever possible; and facilitating pedestrian access between transit stations and street level development.

The City encourages development of pedestrian-oriented facilities, such as those found at Faneuil Hall Marketplace and Downtown Crossing. Controlling vehicular traffic through restrictions on the location of curbscuts and through the use of crosswalks, signals, and traffic restrictions are other methods for making streets safer for pedestrians.

Current regulations and policies have helped to improve transportation in Central Boston and to control the environmental impacts of development. However, additional controls can go even farther to minimize traffic congestion and other adverse impacts of growth on transportation. The environmental review process could assess the cumulative impacts of development on transportation. Because of the number of large projects planned and under construction in Central Boston, the environmental review process should include an overall analytical framework, capable of assessing

the total impact of incremental additions to the city's physical inventory.

Development can provide opportunities to improve transportation: Locating new development near terminals, integrating transit stations into the design of new projects, and improving pedestrian connections between transit stations and the street are all strategies which the City can employ to foster the use of mass transit. Providing an alternative for commuters, water-based transportation could help to alleviate congestion and to conserve energy. Some vessels already transport commuters from the South Shore to downtown, but docking facilities are currently inadequate. If redevelopment along the waterfront were to include and improve docking facilities, ferries could serve as a major source of transportation linking downtown with East Boston and Logan Airport, residential and commercial areas of South Boston, and outlying communities. To promote the use of ferries, the BRA has stipulated that docking facilities be part of the new development planned for Rows/Fosters Wharves. Boston has recently made a number of improvements in transportation downtown. As development proceeds in the next decade, additional strategies and guidelines can make the most of the opportunities which redevelopment presents to facilitate access to and within the city.

NOTES

1. The Commonwealth of Massachusetts Executive Office of Transportation and Construction, and Department of Public Works, "Boston Central Artery: 1977 Origin Destination Study", November 1978.

WATER SUPPLY

Although Boston's demand for water does not exceed its safe yield now, the city's usage is expected to average 153 million gallons per day (mgd), with occasional demands for 161 mgd by 1990. Regionally, the current demand already exceeds the safe yield by fifteen mgd. With the per capita demand growing annually, the Metropolitan District Commission (MDC) predicts a shortfall of seventy mgd systemwide by 1990.

Fresh water is supplied to metropolitan Boston by the MDC, principally through the Quabbin, Ware, and Wachusett Reservoirs in the central part of Massachusetts. These sources provide the potable water supply, as well as water for fire fighting, industrial, and recreational uses. The current regional demand from the forty-four communities served by the MDC system is over 315 mgd. Boston currently draws an average of 140 mgd, slightly less than its estimated safe yield of 141.7 mgd, but more water than any member in the system. Industrial uses in the city account for approximately 12.42 mgd or nine percent of the total usage. Boston Edison consumes the most water (approximately 2.8 mgd), and Gillette, the second largest industrial consumer, uses 1.4 mgd (1975).

Several factors account for the supply system's inadequate capacity. Although Massachusetts is a relatively humid state with an average annual rainfall of forty-three inches, periodic droughts have occurred every six to ten years recently. The

stress on the system is compounded by filling and construction in wetlands areas that feed into the storage system. There is also a growing demand from non-MDC member communities to enter the system, as town reservoirs and wells become depleted or contaminated by toxic waste.

Any new large development or cumulative small developments will place further demands on the overburdened water supply system. If current use and climatic trends continue, serious water shortages could occur before 1990, even without new consumers.

The MDC is currently working toward increasing the capacity of the system. However, it will require at least five years to bring one new reservoir on line. The first additional source, now under consideration by the MDC, would increase the safe yield of the system only enough to meet the current demand. An additional five years will be required to further supplement the system to meet the 1990 demand. The MDC is studying methods of increasing the safe yield of the system and minimizing the demand for water.

REGULATORY CONTROLS, POLICIES, AND STRATEGIES

The authority to improve the water supply system and to minimize additional demands on it is shared amongst State, regional and local agencies: Massachusetts Department of Environmental Quality Engineering (DEQE), MDC, and the Boston Sewer and Water Commission (BWSC). The State also attempts to control additional de-

mand through its building codes, the City through its development review procedures. Each of these entities can play a role in promoting water conservation, an important strategy for managing the future water supply.

The 1977 Massachusetts Water Supply Study estimated that water consumption could be reduced by fifteen to twenty percent over ten years through a program of public education, plumbing code revisions, price structure, and public ordinances.

BWSC, which manages the distribution and service of the water supply within the city, has the authority to employ several strategies to promote conservation. It sets user prices, subject to MDC approval. In as much as price can govern demand, price-setting can serve as one conservation-promoting tool. BWSC may also institute other conservation measures of its own design or those initiated by MDC. For instance, several major sources of unrecorded water usage include leaky water mains, meter slippage, unmetered use, and hydrant use. A primary measure now being implemented by BWSC attempts to eliminate one of these sources; BWSC's leakage detection and repair program has saved approximately fifteen mgd in the past few years.

MDC is currently determining future water needs and methods of improving supply, as is outlined in the Commission's preliminary report, "Phase I of the Northfield Water Supply Project EIR." In addition to its planning function, MDC also initiates and implements conservation meas-

ures. One method employed by MDC is to set appropriate rates for industries discharging effluent into the MDC sewer system, thereby encouraging conservation and recycling by large industrial users.

The State can influence water consumption through DEQE, which has the authority to institute emergency bans on water usage, and through State building codes. In 1978, the Massachusetts Plumbing Code was changed to require low flow showerheads in new construction and renovations. The low flow showerheads could reduce individual household consumption of water by twelve percent. Legislation also was offered in 1979 by the Special Legislative Commission on Water Supply to limit toilets in new and renovated construction to those using 3.5 gallons/flush.

Local governments have several options for promoting conservation that are unavailable to the State and MDC. The City can allocate water to different users within the municipality, and it can enact ordinances related to water conservation. Through the authority of BWSC, the impacts of new development on the water supply system can be mitigated. Measures taken by BWSC to improve the sewerage system, described in the section which follows, will also help to conserve water.

SEWERAGE SYSTEM

Boston's sewerage system is approaching its centennial. Built in 1884, the Boston Main Drainage System included twenty-five miles of main and intercepting

sewer lines. As the city grew, additional lines were added to the system. The northern and southern Metropolitan Sewerage Systems were completed in 1904, and in 1967 the Boston Main Drainage System was connected to the northern Metropolitan Sewerage System.

The Main Drainage System now includes the Boston Main Interceptor, the West Side Interceptor, the East Side Interceptor, and several smaller interceptors which flow into the Main Interceptor. The System carries combined sanitary sewerage and storm drainage from the city and adjacent towns which have connected to these systems to accommodate commercial and residential development.

Because of its age, major portions of the system, especially the East Side Interceptor and Deer and Nut Islands sewerage treatment facilities, are inadequate to accommodate the volume of flow during peak demand periods. When the hydraulic capacity of the mains is insufficient to handle the volume, combined storm water and raw sewerage discharges directly to Boston Inner Harbor and Charles River Basin. Combined sewer overflows (CSOs) are the central cause of pollution in the Harbor and Basin and occur in dry weather, as well as in rainy periods. Dry weather overflows contribute approximately fifty percent of the pollution entering the Inner Harbor through the combined sewer system (The Water Quality section of this chapter describes CSO pollution in more detail).

Inefficient treatment facilities

create other problems. The average daily flow to Deer Island is 310 mgd. The design capacity of Deer Island is 343 mgd, with a peak capacity of 848 mgd. While the design capacity is not yet exceeded, the peak capacity can be surpassed during periods of moderate rain, as well as during periods of excess demand. The Nut Island primary treatment facility has a design capacity of 112 mgd which has been exceeded for several years.

Primary treatment (screening, sedimentation, and skimming) removes virtually all settleable solids and a portion of other pollutants, including toxic metals bound to suspended solids and nutrients which create a high biological oxygen demand. The effluent or liquid by-product of the process is chlorinated to kill bacteria and is then discharged into the Harbor. The sludge or solid by-product is further treated to reduce organic solids and then is discharged into the Harbor. Although the sludge and effluent have undergone treatment, they still pollute.

Leakage from old lines is another major problem with the sewer system. The leaks allow infiltration of fresh and seawater in both the local and interceptor sewers and thus exacerbate the CSOs and demand for treatment by increasing volume.

Development downtown could increase the burden on the sewerage system and detract from the water quality of Boston Harbor and the Charles River Basin, unless steps are taken to improve the system and conserve water. Already several programs are planned and underway to upgrade the capacity



and efficiency of the system, as described below. However, there is a strong need for concurrent water conservation measures in the city to reduce input to the system.

REGULATORY CONTROLS AND POLICIES

The requirements of the Federal Clean Water Act of 1972 and Massachusetts Water Quality Standards have prompted the Metropolitan District Commission and the Boston Water And Sewer Commission to upgrade the sewer system.

Federal legislation mandates eliminating the discharge of pollutants into the navigable waters by 1985 and stipulates that sewerage treatment plant effluents receive a minimum of secondary treatment. Based on engineering studies indicating the benign effect of effluents discharged from Deer and Nut Islands (which receive only primary treatment), the MDC applied to EPA in 1978 and 1979 for a waiver of the secondary treatment requirement. During this period, EPA published the draft and final Environmental Impact Statements on Facilities Planning for the MDC system, in which EPA recommended incineration of sludge from the entire MDC sewerage district at Deer Island. State, regional, and local environmental agencies opposed incineration, and a statement to that effect was developed by Boston Harbor Interagency Coordinating Committee. At the present time, these waste treatment issues are unresolved.

The MDC is currently undertaking the following major

projects to meet the goals of Federal and State legislation: pre-treatment for removal of toxic industrial wastes; replacement of the Boston Main Interceptor and East Side Interceptor sewers; control and treatment of combined sewer overflows; upgrading of the treatment facilities at Deer Island and Nut Island; management of primary sewage sludge from the Islands.

Construction of the Charles River Estuary Pollution Control Facility was completed in 1980. This facility treats CSOs which enter the Basin from Boston, Cambridge, and Somerville. Planning for CSO control in the Inner Harbor has begun, and the MDC has recommended CSO control facilities at eleven other locations in the Inner Harbor, including Fort Point Channel.

The City and BWSC have also taken steps to improve the sewerage system. As part of its Urban Renewal Program, in the late 1970s the City set up an extensive sewer separation program, supported by EPA funding. The BRA initiated design and construction of separation projects for the Charlestown, South End, South Cove, and the Downtown, Waterfront, and Faneuil Hall Urban Renewal Projects. Work on the projects has continued through the coordinated efforts of the BRA and BWSC. The separation is nearly complete downtown; but dry weather overflows, the remaining CSOs, and the insufficient capacity of the East Side Interceptor still cause water pollution.

The BWSC plans to increase the system's capacity by re-

placing the East Side Interceptor, but design and construction may take three to four years. To deal with the Interceptor's current inadequacies, the BWSC has recently required major new construction, such as Fifty-Three State Street, Devonshire Towers, and the Marriot-Long Wharf Hotel, to install waste water holding tanks. The tanks retain sewerage during times of peak demand on the system and discharge it into the Interceptor during off-peak hours. If a development could not accommodate such a requirement, BWSC has the authority to deny the sewer hook-up permit, a prerequisite for a building permit. Map II outlines the areas served by the East Side Interceptor where the inadequacy of the line would affect development. In general, any development within the East Side Interceptor drainage area that would produce over ten thousand gallons per day of waste water, would require a holding tank with a capacity for approximately sixty percent of the average daily flow.

The combined sewer overflow and the dry weather overflow controls, along with the replacement of the East Side Interceptor, should bring the quality of water in the Inner Harbor up to most of the Massachusetts Water Quality Standards. However, standards regulating dissolved oxygen will not be met because separated storm water runoff still carries a significant volume of pollutants including bacteria, heavy metals, and suspended solids.

Concern for energy efficiency is a pressing economic problem for Boston today. The City depends heavily on imported fossil fuels to meet the operational, climate-control, production, and transportation needs of all sectors of the local economy, and Boston depends on growth in those sectors to generate jobs, to increase the tax base, and to maintain the City's vitality.

Only a few years ago, city planning reports made no mention of energy, unless the siting of storage facilities and transmission corridors was an issue. Energy was readily available and relatively inexpensive, hence it was not a factor in development decisions. Foreign oil has quintupled in price since 1973, rising with each supply interruption. With the cold climate and fragile supply systems, Boston, along with the rest of the Northeast, was especially affected. Fuel expenditures have risen in Boston, resulting in a drain on the local economy. In 1978, close to seven hundred million dollars were spent on energy consumption in the city.¹ Today expenditures exceed 1.4 billion dollars, and approximately eighty-five percent of that amount left the local economy in 1981 alone to pay for oil and oil distillates, gas, coal, and uranium. Now energy impacts are a factor to consider in formulating Boston's development policy.

Unreliable supplies of energy can affect future development because they influence the location decisions of firms. A study of corporations showed that energy factors, especially

availability, were of major importance in determining their expansion plans in the United States through 1986.²

Guidelines promoting energy-efficient siting and building design could help to lower the costs of living for local residents and the costs of operating for local businesses.³ Benefits of such guidelines will extend far into the future.

BOSTON'S ENERGY PROFILE

• Consumption

The commercial and institutional sectors use more than half of the energy consumed in Boston.⁴ The major consumers are hospitals; offices in the finance, insurance and real estate sectors; and schools and colleges. The residential sector represents about one quarter of the city's total consumption. In all sectors, oil is the predominant fuel consumed (55.6 percent). In the non-residential sector, however, electricity represents a larger proportion (42.7 percent) of the total energy costs than any other single energy source.

In each sector, except for manufacturing and transportation, the largest amounts of energy are needed for space heating purposes. In residential buildings, water heating is the most important use. In the commercial and municipal sectors, lighting is second most important. The industrial sector uses most of its energy to generate process steam. Chemical, food and paper industries are the major industrial energy consumers. If Boston's demand distribution remains unchanged,⁵ commercial space conditioning

and lighting will account for most of the energy used in Central Boston, and residential space conditioning will follow in importance.⁶

• Supply Systems

Boston's electric utility, Boston Edison Company (BECo), serves forty cities and towns in the Greater Boston area. BECo has peak generating capacity of 2,723 Megawatts (MW), consisting of a mix of sixty-three percent oil, thirty percent nuclear, and seven percent gas turbines and diesels. In 1980, total system peak load was 2,100 MW, and the total system energy requirements were 10.7 million megawatt-hours (MWH).

BECo is a member of the New England Power Pool (NEPOOL), the regional power sharing and planning association. For the short term, heavy reliance on electricity has serious economic implications because BECo and NEPOOL are still approximately sixty percent dependent on imported oil. Planned conversion of much of the electric generating capacity from oil to coal, nuclear, hydro, and wood could reduce both BECo's and NEPOOL's oil dependence to approximately ten percent by 1987.⁷ Because of its high cost, it is important that Boston consume electricity as efficiently as possible in order to minimize the city's energy dollar outflow and reduce its vulnerability to supply interruptions.

BECo owns Boston's steam district heating system. The system is old, relatively inefficient, and no longer competitive with other energy sources.⁸ By

contrast, Northern European communities, where efficient district heating systems have been in use for the last twenty years, consume forty to sixty percent less fuel for heating, cooling, and electricity than American cities. A forty percent reduction in Boston's space heating and hot water bill would lead to savings of approximately three to four hundred million dollars annually (1981 dollars).

Boston Gas Company sells and distributes gas to residential, commercial, and industrial customers in the city and in seventy-three other cities in eastern Massachusetts. On peak days in 1981, Boston Gas distributed 572 million cubic feet (MMCF) from a variety of sources: natural gas from major pipelines (forty-seven percent), liquified natural gas (LNG) (fifty percent), synthetic natural gas (two percent), and propane (one percent).⁹ In the winter of 1980-1981, the 66,521 MMCF sendout was supplied by pipeline gas (seventy-seven percent), LNG (17 percent) and synthetic natural gas (six percent).¹⁰

In the short-term, Boston is unlikely to increase its reliance (17.5 percent in 1978) on natural gas as a fuel source.¹¹ In fact, Boston Gas currently has a moratorium on new service commitments. Proposals for new facilities to expand service are in preliminary stages. Currently, gas supplies for commercial and industrial developments in Boston are uncertain. Boston Gas is dependent on LNG from Algeria, a source of questionable stability. Even brief interruptions of Algerian LNG,

such as the weather-delayed shipments in 1981, would contribute to local shortages of gas. In the event of a domestic gas shortage, the Federal Energy Regulatory Commission would curtail supplies to commercial and industrial customers before depriving higher priority residential and institutional customers. Regardless, even if natural gas continues to cost less than other fuels, natural gas customers will pay much more than they do currently.¹²

Boston Gas expects to expand its supplies and serve more customers in the next few years.¹³ However, uncertainties in the availability and price of natural gas give Boston Gas an unpredictable role as an energy source for new development in Boston.

ENERGY EFFICIENT SITE AND BUILDING DESIGN

One of the most effective mechanisms for the City to promote energy efficiency is through controls on the siting and design of buildings. As noted in the section on wind, shadow, and noise, development can affect the microclimate in localized areas, which in turn affects energy consumption. Site and building design can minimize the undesirable impacts on the microclimate, take advantage of the site's desirable characteristics, and thus limit the amount of fossil fuel-derived energy required. Careful controls of building mass, configuration, orientation, fenestration, exterior wall design, materials, and color can make a difference in the city's total fuel consumption.

Choosing the proper controls to achieve optimal energy savings requires careful analysis of specific projects. In many cases, trade-offs amongst the array of design opportunities is required. Within a framework of general rules, there needs to be flexibility for achieving the optimal savings for each development.

General rules can be applied to the process of designing a building for Boston's climate and energy system. The following sections outline some possibilities and important considerations for site layout and building design.

- Building Orientation

Building orientation significantly affects energy requirements. The path of the sun, the directions local wind patterns, and the position of other structures are of particular concern and need to be considered carefully in light of projected building uses.

Boston, in comparison to many other American cities, can benefit from the solar energy available. With thoughtful site planning and building design, solar energy can substantially reduce Boston's fossil fuel dependence. To do so, new construction should optimize solar exposure (shade in summer and gain in winter); minimize wind turbulence, especially at the street level; minimize exposure to prevailing winds; and minimize adverse shadow and wind impacts on neighboring parcels.

- Building Massing

To reduce the amount of energy lost through con-

ductance, the most efficient building shape is a cube. Relative to building volume, this shape has a minimum of exposed surface through which unwanted heat loss or gain could occur.

As buildings increase in height, they are subject to significant internal drafts; consume substantial amounts of energy (elevators can account for as much as seven percent of a building's total energy consumption), and create wind turbulence which affects neighboring buildings.

The creation of internal drafts, known as the chimney effect or stack induction action, can disrupt the internal climate and reduce the efficiency of air conditioning. Drafts down stairwells and shafts can suck conditioned air out of working areas, creating the need for more heat or air conditioning. Wind turbulence created by tall buildings can increase energy consumption in neighboring buildings because the turbulence heightens thermal losses. Because of these potential impacts, buildings should be massed to minimize the amount of exposed building surface, internal draft effects, and external wind turbulence.

- Landscaping

Boston is one of the windiest cities in the country. This poses problems for energy-conscious builders. High winds generate a great demand for energy. For example, a house of conventional construction has 2.5 times the heating load in a nineteen mile per hour wind as in a three mile per hour wind at the same

temperature. Wind analysis and landscape planning can reduce building energy consumption, while increasing the comfort of pedestrians and inhabitants.

Shading can reduce surface temperatures of sunny surfaces by twenty to thirty degrees Fahrenheit. Similarly, ambient air temperatures over paved surfaces can be higher than those over planted areas by as much as thirty-five degrees during summer months. Therefore, reducing ambient air temperatures around buildings can lead to significant reductions in the cooling load.

This can be achieved by landscaping sites so that as much of the site's paved surfaces and the building surfaces as possible are shaded by deciduous trees; as much of the site as possible is planted with grass, particularly immediately around buildings; and evergreen windbreaks are placed on the north and west sides of buildings at appropriate distances.

- Life-Cycle Costing

Life-cycle costing (LCC), prior to the construction of a building, can insure both energy savings and optimal capital allocation. This costing method allows the computation of total cost of ownership over the expected life span of an asset and compares that with the initial construction cost. Many private engineering and architectural firms now utilize computerized LCC programs to determine which available technologies will give developers maximum energy savings over their period of ownership for the least first cost. In addition, a number of Federal agencies have adopted the methodology

and procedures for LCC analysis developed by the Department of Energy and the National Bureau of Standards.

ENERGY SYSTEM TECHNOLOGIES

Though not all energy systems are cost-effective for all locations, some systems can perform well in Boston and reduce the city's total consumption of fossil fuels. Unlike oil, many alternative energy sources, such as some heat pumps, geopumps, and windmills, deliver more usable energy than they consume. The following section describes alternatives to Boston's current energy sources.

- Solar Power

Active systems are being installed in large numbers throughout New England, principally for residential hot water. There also are a growing number of commercial, institutional, and industrial systems being installed. Passive systems, on the other hand, are generally an integral part of a structure's basic design, rather than an added on feature. Passive solar designs for all building uses are becoming less expensive, and a reliable, aesthetic, and comfortable means of providing heat and light.

- Wind Power

Although the presence of high annual average wind speeds makes the generation of electric power from wind systems feasible in certain locations in Boston, implementing such systems is complicated. Once adequate site-specific wind

energy is commonly referred to as cogeneration. Cogenerators are designed to produce either electricity or heat primarily. In the former case, an engine turns an electric generator while waste heat from the engine is captured to heat rooms and water. In the latter case, boilers produce steam which typically performs process or heating functions before turning an electricity generating turbine. The advantage to these systems is speed tests have been conducted, the potential user must negotiate with the electric utility company and with community groups which might oppose the project. The Boston Zoning Code, however, presently exempts windmills from height limits.

- Cogeneration

The simultaneous generation of useful heat and electric that the operator is making productive use of what, for a traditional boiler system, is waste heat. The best of these systems delivers 850 useful Btus for each one thousand Btus of fuel put into it. This is compared to 330 useful Btus of electricity delivered for each one thousand Btus of fuel burned in the electric utility's boilers.

Cogenerators can be sized small enough to meet the needs of just one or two houses or large enough to serve millions of square feet of institutional demand. Unless a unit is large enough to emit one hundred tons per year of a regulated pollutant, it will not be subject to air pollution regulations. The Massachusetts Department of Public Utilities regulates ar-

rangements between cogenerators and other small power producers and the utility companies.

- District Heating

Frequently a companion to cogeneration, district heating provides space heat and hot water to many buildings. Boston currently has a district heating system downtown, owned and operated by Boston Edison Company. However, it is old and expensive to operate. District heating sales are not regulated by the Massachusetts Department of Public Utilities, the City of Boston, or any other public agency. Boston Edison does not hold an exclusive franchise in Boston. Certain neighborhoods and districts of Boston are more appropriate than others for district heating. Areas, such as Fort Point Channel, with extensive and diverse energy demands, are necessary to justify the capital costs of a district heating system.

- Heat Pumps

Heat pumps are an old technology receiving renewed attention. They are devices which "pump" a heat-carrying medium through a heat exchanger. Generally, they are reversible and can heat in winter and cool in summer. The old-fashioned window air conditioner is a one-way heat pump which uses freon as the medium and copper fins as the heat exchanger. New versions of the heat pump use water, air, and other media to carry heat, and they use the air, ground water, a body of water, or the earth as source of heat or as heat sinks (places to dump

heat in the summer).

There are several advantages to heat pumps. First, they are efficient and consume little fuel to operate. Their coefficients of performance (CoP) are usually well above one, usually between two and three and sometimes as high as fifteen, as compared with an electric resistance heating unit with a CoP of one. Second, they are even more economical when used in conjunction with a thermal storage system whereby the storage medium can be heated or cooled at night when the demand for and cost of electricity are less. The stored energy can then heat or cool the building the following day, when costs and demand are higher.

CONCLUSION

While the City of Boston cannot control all the factors affecting energy supply and demand, it can promote energy efficiency through development guidelines. Site and building design controls could reduce energy consumption. The City could also promote the use of alternative energy systems, protecting solar access in appropriate locations and promoting systems appropriate for specific areas.

NOTES

- 1 Xenergy, Inc., "Energy Profiles of the Municipalities in Suffolk County, Burlington, MA (May, 1981). This study was performed under a contract with the Suffolk County Extension Service as part of their Project for Reliable and Affordable Energy

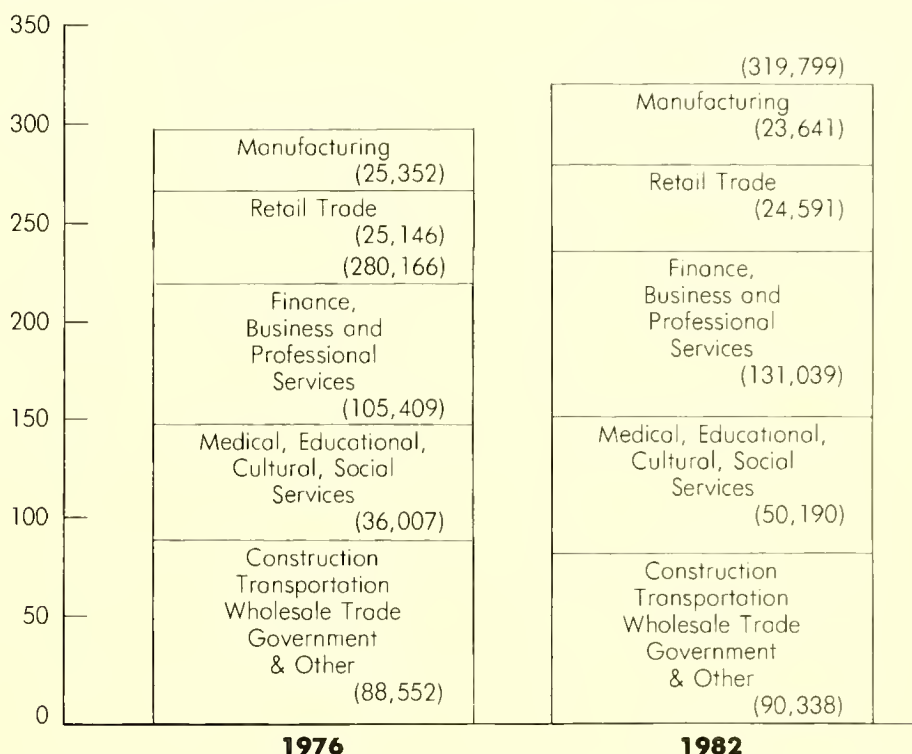
2. Fortune Magazine, "Facility Location Decisions," (New York; September 1977), p. 31. Fortune surveyed one hundred U.S. firms on the comparative importance of factors in locating their next mainland U.S. plant. Data was derived from plans for expansion through 1986.
3. Connelly, J., Lewis Cohen, and Robert Persons, "Energy Efficiency through Site and Neighborhood Design: A Report to the Boston Redevelopment Authority," The MITRE Corporation (Bedford, MA: July, 1981), pp. 1-3.
4. Xenergy, Inc., Most of the information on energy consumption contained in this chapter is derived from this study.
5. It is assumed there will be a short-term shift of indeterminate scale away from oil-fired boilers toward gas-fired boilers and electric heat pumps, based on current prices.
6. Residential space conditioning will be affected primarily by the retrofit efforts of individual homeowners and landlords. Building department records reveal that fewer than a dozen applications are filed annually for new single family residential construction. Multifamily buildings generally fall within the jurisdiction of the BRA's design review powers and will be affected by BRA policy. Most single-family construction, however, does not. This sector and retrofit efforts are thus outside of the scope of this publication.
7. NEPLAN, "NEPOOL Forecast for New England: 1981-1996," New England Power Pool (West Springfield, MA: April, 1981). Additional data obtained from the Boston Edison Company Rates and Research Department, June, 1981.
8. Connelly, J., Lewis Cohen, and Robert Persons, p. 391 et seq.
9. "Joint Long-Range Forecast of Boston Gas Company and Massachusetts LNG, Inc.," Filed with Massachusetts Energy Facilities Siting Council, April 15, 1981, Table G-23.
10. Ibid, Table G-5. The split-season is April 1st through March 31st.
11. Historically, natural gas suppliers in southern regions of the U.S. have given priority to intrastate markets. Because interstate gas prices have been controlled by the Federal government, gas suppliers have sold gas for higher prices within their own states, and limited the amount of gas available for interstate markets. Boston's position near the end of major gas pipelines means that contracted supplies are limited and prices are higher than in locations closer to the gas-producing states.
12. The American Gas Association (Energy Analysis, November 1980) expected gas prices to increase 13.5 percent annually between 1980 and 1990, based on an assumed inflation rate of 6.9 percent per year.
13. Boston Gas Forecast, p. 17.

Introduction

To expand on information provided in the chapters on economic development, this chapter provides an overview of the transformation of the economy and physical inventory of Central Boston and notes significant employment trends.

Boston's economy has undergone a fundamental structural transformation since 1950, as the finance and services sectors have become more dominant than manufacturing and trade. Between 1950 and 1982, Boston lost over 118,000 jobs in manufacturing and trade, but gained 133,000 jobs in the broadly-defined service and finance industries. Since 1976 however, manufacturing employment has become more stable, and the rate of decline in employment in retail trade has diminished. Boston's economy is now more diversified, less dependent upon the cyclically-sensitive manufacturing sector, and more closely in line with sectors of growth nationwide.

Table IX-2 Central Boston Employment 1976, 1982 (in thousands)



Central Boston has played an important role in the city's economic transformation, and employment levels there have grown steadily. In 1976, em-

ployment in Central Boston totaled 280,000 jobs, approximately fifty-six percent of all jobs in the city. The total number of jobs in Central Boston increased to 320,000 by 1982, fifty-nine percent of the city's total employment.

Eighty-nine percent of the job growth in Boston in that period resulted from employment gains in Central Boston. After 1976 most employment gains resulted from the growth of office-related jobs, although the rate of decline in manufacturing and retail trade diminished. However, the office sectors did not expand uniformly: little growth occurred in public office employment, and rates of growth varied by office type. The shift toward a broad range of growing services industries in Central Boston led to

Table IX-1 Boston Employment Trends 1950-1982

	1950	1960	1970	1975	1980	1982
TOTAL	523,171	530,800	551,892	507,082	548,497	546,205
Agriculture & Mining	1,737	1,275	717	819	518	544
Construction	19,898	17,836	20,490	16,126	14,663	10,422
Manufacturing	101,586	87,838	64,859	51,504	51,861	49,667
TCPU*	36,848	40,750	41,351	34,756	36,660	35,882
Trade	145,962	125,581	121,481	93,283	83,027	80,288
FIRE**	49,321	55,081	69,452	60,858	70,451	76,720
Services	87,224	103,375	131,575	152,000	187,991	192,900
Government	77,404	87,158	90,022	86,926	96,017	87,817
Proprietors	12,191	11,906	11,945	10,810	11,764	11,965

Because of employment reclassification in 1977, 4,500 engineering jobs were transferred from construction to services.

* Transportation, Communication, and Public Utilities.

** Finance, Insurance, and Real Estate.

Source: Massachusetts Division of Employment Security, ES-202 file for Boston and Suffolk County, U.S. Department of Commerce, Bureau of Economic Analysis.

Table IX-3 New Central Boston Employment by Occupation 1976-1982*

Occupations	Office	Retail	Institutional	Hotel	Manufacturing	Construction	Total by Occupation Number	Percent
Professional & Technical	7,410	128	1,960	39	67	68	9,672	30.2%
Managerial	1,950	236	570	86	64	168	3,074	9.6
Clerical	8,190	644	2,268	211	141	123	11,577	36.2
Sales & Service	585	526	292	125	32	17	1,577	4.9
Operatives & Laborers	1,365	967	850	1,100	696	1,125	6,103	19.1
TOTAL	19,500	2,501	5,940	1,561	1,000	1,501	32,003	100.0%

* These are net new jobs created by development projects in the Central Business District and Back Bay, the areas of Central Boston where employment is concentrated, less those filled by replacement or transfers.

Source: Boston Redevelopment Authority. Occupational distribution calculated from jobs in Table II for each individual economic sector except institutional which was set at the average of all other economic sectors.

Occupational distributors were originally aggregated for each economic sector according to separate industries from Mass. Division of Employment Security, "Occupational Profiles."

a strong recovery from the serious national recession of 1974-1975.

BOSTON'S LABOR FORCE

An occupational profile of the city's labor force shows the effects of the changing economy on the demand for labor. There are now many more white collar occupations — professional, technical, managerial, clerical, and sales positions — in the Boston economy than there were in 1960, as Table IX-4 indicates. Boston's resident workforce has

adapted to this change by taking a greater share of professional, technical, and managerial positions. Between 1970 and 1980, the percentage of Boston residents in such positions increased from twenty-two to thirty percent. Relative to white collar occupations, blue collar positions outside of the service sector have become scarce. The percentage of Boston residents holding such jobs has declined.

Along with the structural transformation and the in-

creasing proportion of professional, technical, and clerical jobs (seventy-one percent of jobs created between 1975 and 1982 in Central Boston fall in these categories), came changes in the composition of Boston's labor force. More women, minorities, and young people are now included.

Between 1970 and 1980, the percentage of all women working increased from forty-eight percent to fifty-four percent and included sixty-nine percent of all women aged twenty-five to

Table IX-4 Occupation Profiles, City of Boston

Occupation	1960		1970		1980	
	Boston Resident Occupational Distribution	All Jobs in Boston	Boston Resident Occupational Distribution	All Jobs in Boston	Boston Resident Occupational Distribution	All Jobs in Boston
Professional	12.5%	14.5%	16.5%	16.3%	20.0%	22.0%
Managerial	5.8	9.7	5.5	9.5	10.0	10.0
Clerical	22.2	26.0	26.6	26.8	23.0	28.0
Sales	7.0	8.9	5.7	8.6	7.0	6.0
Craftsmen	12.6	12.2	10.3	11.8	8.0	
Operatives	20.5	15.0	14.1	13.0	10.0	21.0
Service	14.6	11.0	16.7	11.3	18.0	14.0
Laborers	4.9	3.0	4.5	2.7	4.0	
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: U.S. Census, Department of Commerce, 1960, 1970 and 1980, *General Economic and Social Characteristics, Massachusetts*. U.S. Bureau of Economic Analysis and Massachusetts Division of Employment Security.

Table IX-5 Jobs Created for Boston Residents by Development in Central Boston 1975-1982

Economic Sector	Total Jobs Created	Resident Jobs Created	
		Number	Percent
Office*	34,428	10,294	29.9%
Retail	1,256	502	40.0
Institutional	8,020	3,168	39.5
Medical	6,081	2,402	39.5
Educational	1,664	657	39.5
Cultural	275	109	39.5
Hotel	1,918	959	50.0
Manufacturing	263	166	63.1
Government	4,266	2,880	67.5
TOTAL	50,151	17,969	35.8%

Source: Boston Redevelopment Authority, Research Department, Estimated from surveys and industry contacts, 1981.

forty-four. Boston's total labor force, sixty-two percent of Bostonians older than fifteen years, is fifty-three percent male and forty-seven percent female. Fifteen percent of Boston's adult labor force is comprised of minority participants. Minorities have a low labor force participation rate of fifty-nine percent, but Boston's minority labor force share is triple the size of that for the whole metropolitan area. Also, compared to that of the metropolitan area, the city's labor force continues to have a

higher concentration of workers between the ages of sixteen and twenty-four. Boston's female labor force participation rate is greater than that for the nation (fifty-four to fifty-one percent), while its minority rate is lower (fifty-nine to sixty-two percent).

RESIDENT EMPLOYMENT

From 1975 to 1983, development in Central Boston created nearly eighteen thousand new jobs for Boston residents, a capture rate of thirty-six percent, as

Table IX-5 shows. The resident capture rate varies among the commercial and institutional sectors. Although office industries have the smallest resident job capture rate (thirty percent), extensive office development created the most job opportunities for Boston residents of any economic sector in Central Boston.

Expanding medical institutions created over twenty-four hundred new permanent jobs for Boston residents. Growth of educational, cultural, and other institutions added another seven hundred new resident jobs between 1975 and 1983. Institutions hire residents for forty percent of all jobs, slightly above the rate (thirty-five percent) for all Boston jobs.

The remaining sectors of the economy fostered the growth of nearly two thousand jobs for Boston residents. Retail, hotel, manufacturing, and government industries all hire an above average share of Boston residents. Two large manufacturing expansions in Central Boston, those of Teradyne and New England Nuclear, resulted in over 150 resident job opportunities, sixty-three percent of all new manufacturing jobs.

Two occupational categories dominate the profile of newly-created jobs for Boston residents. Professional/technical occupations totaled 6,783, or thirty-eight percent, of all new resident jobs, probably because of growth in office industries and medical and educational institutions. The 6,312 new clerical jobs represented thirty-five percent of the new resident jobs. An estimated 3,125 service

Table IX-6 Occupations Created for Boston Residents by Development in Central Boston 1975-1982

	Number of Jobs	Percent
Professional/Technical	6,783	38%
Managerial	1,749	10
Clerical	6,314	35
Maintenance/Production	1,263	7
Service and Sales	1,862	10
TOTAL	17,969	100%

Source: Institutional, Retail and Government occupations from Massachusetts State Occupational Profiles.

Office: From *The Office Industry Survey*, 1978.

Hotel: From *Hotel and Convention Center Demand and Supply in Boston*, 1979.

Manufacturing: Based on occupational profile provided by expanding manufacturers.

Table IX-7 Comparison of Boston's Resident and Commuter Labor Force 1960-1980

	1960		1970		1980	
	Number	Percent	Number	Percent	Number	Percent
Residents	234,753	44	203,233	37	192,360	35
Commuters	296,047	56	348,004	63	356,137	65
TOTAL	530,800	100%	551,237	100%	548,497	100%

**Table IX-8 Occupational Comparisons, 1980
Boston Resident Labor Force with Total Boston and Metropolitan Area Employment**

Occupation	Boston Resident Workers	Total Boston Jobs	Boston Suburban Jobs
White Collar	60%	66%	54%
Professional & Technical	20	22	16
Managerial	10	10	10
Clerical, Administrative	23	28	21
Sales	7	6	7
Blue Collar	22	21	32
Craftsmen	8	-	-
Operatives	10	-	-
Laborers	4	-	-
Services	18	14	13
TOTAL	100%	100%	100%

Source: Total Employment, U.S. Bureau of Economic Analysis.
Resident and Commuter Employment from 1960, 1970, and 1980 U.S. Censuses.
Occupational Comparisons from U.S. Census Bureau for Resident Workers and Mass. Division of Employment Security for City and Suburban Jobs.

Table IX-9 Downtown Boston Employment Projections 1982-1992

	1982	1992	Change 1982-1992	
			Number	Percent
Agriculture & Mining	446	454	8	1.8
Construction	3,802	4,656	854	22.5
Manufacturing	23,641	25,769	2,128	9.0
TCPU*	15,740	17,418	1,678	10.7
Wholesale Trade	14,639	16,410	1,771	12.1
Retail Trade	24,591	28,471	3,880	15.8
FIRE**	60,752	73,322	12,570	20.7
Services	120,477	153,479	33,002	27.4
Hotel	6,189	8,343	2,154	34.8
Medical	17,698	22,742	5,044	28.5
Educational	15,619	15,385	- 234	- 1.5
Cultural	1,951	2,246	295	15.1
Solid/Non-Profit	14,922	18,799	3,877	26.0
Business	24,068	34,851	10,783	44.8
Other	40,030	51,113	11,083	27.6
Proprietors	5,720	4,862	- 858	- 15.0
Government	49,991	47,891	- 2,100	- 4.2
TOTAL	319,799	372,732	52,933	16.6

* Transportation, Communication, and Public Utilities.

** Finance, Insurance, and Real Estate.

Source: See Table IX-2

and blue-collar resident jobs were created by new development, a seventeen percent share of the total new employment generated.

The total occupational mix of resident jobs created was weighted toward white-collar positions.

Resident jobs created by development in Central Boston between 1975 and 1982 have benefited the city's economy. Boston's resident labor force unemployment rate fell from 12.8 percent in 1975 to 6.1 percent in 1980. During the 1980-1982 recession when the national unemployment rate rose to 9.7 percent, Boston's rate averaged only 8.3 percent. The addition of eighteen thousand jobs for residents contributed to the lower rate. The resident job capture rate, however, has fallen from thirty-seven percent in 1970 to thirty-five percent. As Boston's population declined, metropolitan area residents captured 32,000 of new jobs; their employment contributes to the strength of Boston regional economy.

Overall, opportunities for Boston's labor force have improved with diversification of the city's economic base. Although some problems still exist, the city's labor force is adjusting to structural changes in the economy, and continued economic growth is likely to improve the prospects for employment of additional workers.

EMPLOYMENT PROJECTIONS

According to economic projections, the number of people employed in Central Boston may reach 342,410 by 1992. Growth

in the office-based employment will continue as a major force in the local economy, and there are likely to be moderate gains in most other sectors as well, as Table IX-9 indicates.

Sources used to project economic growth and development activity include the Bureau of Labor Statistics (BLS) long-range forecast of output and employment for U.S. industries and the Massachusetts Division of Employment Security's (MDES) state-wide forecast. The BLS' model of national economic trends includes labor force characteristics, labor productivity, government revenue and expenditure policies, changes in consumer preferences, competition from foreign products, and changes in business purchasing and investment patterns. Selecting from BLS' and MDES' data those growth rates which approximate Boston's economic characteristics (i.e., industry mix, recent growth trends, constraints and stimulants to the local economy), it is possible to forecast 1992 employment levels for the city and for each of its economic development sectors. The projections measure growth potential and are not meant to serve as rigid targets or predictions. In the chapters on economic development at the beginning of this report, these employment projections are examined together with other indicators of growth and demand for each economic sector in Central Boston. This provides a view of the long-range economic potential for each sector and of the match between short-term economic potential and actual development activity. Additional employment data is contained in the Employment Appendices of this report.

OVERVIEW / Physical Development

Most development activity and employment gains occurred in the office and institutional sectors. Between 1975 and 1983, 8.5 million square feet of new office space was built in Central Boston. The 5.2 million square feet of new space constructed in 1975 represented the end of the previous building boom. After 1975, the average net annual increase in office stock was 550,000 square feet, while absorption (the amount of additional space leased) averaged over 900,000 square feet per year.

Office vacancy rates fell from a peak of fifteen percent in 1977, to three percent in 1983, and contributed to rising rents for Class A office space. Office space shortages encouraged the growth of rehabilitation and conversion projects, which became increasingly popular after 1976. Downtown, the center for new construction, was also the location of renovation, such as those made to Faneuil Hall Marketplace and Downtown Crossing. Back Bay buildings provided opportunities for numerous, small renovations.

Although some of the office space is tax-exempt, most of the development (eighty-six percent of the total construction costs) contributes to Boston's tax base. The taxable office projects comprise fully sixty-nine percent of the construction costs of all taxable major developments completed in Boston between 1975 and 1982.

Medical and educational institutions have expanded, adding over three million square feet in Central Boston. Most projects were newly constructed or were

additions to existing buildings. However, cultural institutions improved their space by rehabilitating small theaters, tourist, and recreational facilities. The Federal Reserve Bank was the only public building completed between 1975 and 1983, though several schools and public facilities underwent renovation. Retail development took place at a moderate pace between 1975 and 1983; slightly more than 480,000 newly-constructed and 730,000 square feet of retail space was rehabilitated. However, there was little net increase in retail space, due to several losses downtown.

Reversing a long-term trend, manufacturing experienced a modest upswing in Central Boston with the completion of two major manufacturing projects: Teradyne in the Leather District and New England Nuclear in the South End. According to market surveys, there was also growing interest by manufacturers to locate in Central Boston, close to its work force and transportation network. Over 2.3 million square feet of industrial space has been constructed in Central Boston since 1975.

According to Boston Landmarks Commission records, seventy-five structures listed on or eligible for the National Register of Historic Places underwent significant rehabilitation between 1975 and 1982. Many other buildings of architectural merit also benefited from major rehabilitation. Some historic buildings, including sixteen structures on or eligible for the National Register, and a number of buildings of lesser architec-

tural importance were demolished to make way for new structures.

Table IX-10 summarizes recent development in Central Boston and projects scheduled for completion by 1986. The Development Appendices provides a complete listing of Central Boston's development between 1975 and 1987, the costs and tax status of development.

Table IX-10 Central Boston Development Summary**New Construction** (Public and Private)

Year	Office (S.F.)	Retail (S.F.)	Medical (S.F.)	Educational (S.F.)	Cultural (S.F.)	Transport. (Cars)	Industrial (S.F.)	Hotel (Rooms)	Exhibition (S.F.)	Residential (D.U.)
1975	5,213,000	20,000	99,000				105,000	428		165
1976	1,278,500		388,600	32,500						916
1977	1,023,000	10,000								151
1978		380,000	400,000	127,000						478
1979										171
1980	8,200	14,500	860,500							27
1981	990,000	48,000	287,000		80,000		18,300	80		150
1982		10,000	396,096			400	51,000	922		
1983	1,123,500	377,000	339,000			2,505	46,500	804		748
1984	3,668,000	429,000	128,000			1,637	100,000	1,934		225
1985	733,000	79,000	26,000		30,000	1,508	160,000			370
1986	945,000	86,500		55,000		2,250				400
TOTALS	14,982,200	1,454,000	2,924,196	214,500	110,000	8,300	480,800	4,168		3,801

Converted Space (Public and Private)

Year	Office (S.F.)	Retail (S.F.)	Medical (S.F.)	Educational (S.F.)	Cultural (S.F.)	Transport. (Cars)	Industrial (S.F.)	Hotel (Rooms)	Exhibition (S.F.)	Residential (D.U.)
1975										120
1976										155
1977										
1978										
1979										117
1980										268
1981	46,200					362		330		455
1982	34,000									
1983	180,000	17,000					323,000			128
1984	43,601	39,732				1,281	875,000			580
1985	38,880	19,440			6,500	134	875,000			332
1986	58,770	34,380								55
TOTALS	401,451	110,552			6,500	1,777	2,073,000	330		2,210

Rehabilitated Space (Public and Private)

Year	Office (S.F.)	Retail (S.F.)	Medical (S.F.)	Educational (S.F.)	Cultural (S.F.)	Transport. (Cars)	Industrial (S.F.)	Hotel (Rooms)	Exhibition (S.F.)	Residential (D.U.)
1975		66,000								93
1976	200,000	75,000								16
1977	200,000	130,000								
1978	330,000	195,000					773,100			417
1979	616,900	57,000					312,600	900		283
1980	376,800	52,800		56,000			240,315			404
1981	997,300	58,200		129,000	52,000		378,022	300		96
1982	1,946,760	96,000		10,000	100,000		623,500	428		141
1983	754,050	12,600	70,000				373,000			251
1984	592,300	61,700					562,000	1,630	1,100,000	15
1985					100,000		725,200			118
1986	30,000	30,000								
TOTALS	6,044,110	834,300	70,000	195,000	252,000		3,987,737	3,258	1,100,000	1,834

* See Development Appendices Table 1 for a detailed listing of projects. This summary includes projects which have received BRA approval; several sizeable projects remain in the proposal stage. Their construction will alter the development magnitudes indicated here.

The ongoing and substantial physical renewal of Central Boston is manifest by recent excavations, construction cranes on the skyline, and the completed buildings themselves. The economic recovery which has accompanied this redevelopment is significant, especially at a time when the national economy has not fared well.

Maintaining the current vitality of Central Boston's economy, achieving the growth projected throughout the decade, and managing future changes downtown for the benefit of all of Boston presents many challenges for the City. The development issues which confront the City over the next ten years, as outlined in this study, are complex. Resolutions will require the collaboration of public and private entities city-wide. The range of perspectives, expertise, and advice that public agencies, private groups, and individuals can offer will assist the Boston Redevelopment Authority as it initiates the second phase of Boston Tomorrow.

The second phase will result in a development strategy and specific guidelines for managing growth and change in Central Boston over the next ten years. Reflecting major sections of this report, the guidelines will address four categories: economic development, residential development, design, and environment. A preliminary draft of the guidelines will be available for public review in the fall of 1983.

To assist in guiding the development of Central Boston, the BRA encourages interested groups and individuals to contribute their ideas and in-

sights in response to the information contained in this report and to the draft guidelines. Opportunities for review and participation will be presented as various policy options are considered. Through a collaborative effort, one which embraces the diversity of interests in Boston, the City can work toward ensuring that the economic growth and physical development of Central Boston will expand employment and housing opportunities, improve the City's fiscal profile and the investment climate, and enhance the unique character and quality of life throughout Boston.

Table 1 Stationary Sources of Hydrocarbon Emissions within Inner Metropolitan Boston

Source Category	Size Category				Area Sources Emissions, tan/year
	≥100 ton/year		25 to 99 ton/year		
	Number of Sources	Emissions	Number of Sources	Emissions	
Gasoline					
Storage losses	7	1,320	6	294	0
Wholesale transfer	1	133	11	355	0
Service Station Tank Filling	0	0	0	0	422
Service Station Vehicle Filling	0	0	0	0	3,150
Surface Coating*					
Coil	0	0	0	0	468
Fabric	3	2,960	2	106	408
Paper	2	409	2	140	1,281
Can	0	0	0	0	809
Automotive Assembly	0	0	0	0	0
Metal Furniture	0	0	3	98	51
Fabricated Metal Products	0	0	14	251	138
Small and Major Appliances	0	0	0	0	407
Wood Paneling	0	0	0	0	0
Insulation	0	0	0	0	14
Trade Paints	0	0	0	0	4,279
Printing	2	958	6	92	4,397
Paint Manufacturing	0	0	3	119	186
Tank Manufacturing	0	0	0	0	141
Chemical Manufacturing	2	2,507	3	241	225
Dry Cleaning	1	135	4	186	2,251
Degreasing	3	507	14	435	4,772
Rubber Products	0	0	2	101	1,352
Plastic Products	0	0	2	14	3,107
Leather Products	0	0	0	0	443
Pharmaceuticals	0	0	0	0	690
Adhesives	0	0	4	149	175
Fuels, Other Than Gasoline	0	0	0	0	0
Fuel Combustion					
Steam Generators	2	245	1	43	12
Industrial/Commercial	0	0	0	0	667
Residential	0	0	0	0	401
Incineration	0	0	0	0	82
Mobile Sources					
Highway Vehicles	X	X	X	X	57,080
Rail	X	X	X	X	338
Vessels	X	X	X	X	1,287
Aircraft	1	1,736	X	X	0
Other	X	X	X	X	396
Other Organic Solvent Emissions					
Process Emissions	1	515	2	60	1,281
Storage Evaporation	0	0	0	0	0
Distribution	0	0	0	0	0

Table 2 Federal and State Ambient Air Quality Standards

Contaminant	Duration of Indicated Concentration	Primary Standard Average Concentration		Secondary Standard		
		ug/m ³	ppm	ug/m ³	ppm	
Sulfur Oxides (SO ₂)	Year	80	0.03	None	None	Arithmetic Mean
	Day	365	0.14	None	None	Maximum
	3 Hour	None	None	1,300	0.5	Maximum
	1 Hour	None	None	None	None	-
Total Suspended Particulates (TSP)	Year	75	-	(60) ^a	-	Geometric Mean
	Day	260	-	150	-	Maximum
Carbon Monoxide (CO)	8 Hour	10 (milli-grams)	9	Same	Same	Maximum
	1 Hour	40 (milli-grams)	35	Same	Same	Maximum
Ozone (O ₃)	1 Hour	235	0.12	Same	Same	Maximum
Hydrocarbons (non-methane)	3 Hour ^b	160	0.24	Same	Same	Maximum Between 6 and 9 AM
Nitrogen Oxides (NO ₂)	Year	100	0.05	Same	Same	Arithmetic Mean
Lead (Pb)	3 months	1.5	-	Same	-	Maximum Arithmetic Mean

Annual standards are never to be exceeded. Other standards may be exceeded once per year, except ozone, which is not to be exceeded more than 1 day per year over a three year period.

In Massachusetts, the primary standards for carbon monoxide, photochemical oxidants and hydrocarbons and the secondary standards for particulates are now to be met by 1987. Secondary standards for SO₂ and NO₂ are being met now.

a) A guide to be used in assessing implementation plans to achieve the 24 hour standard.

b) A guide to achieve oxidant standards.

Table 3 Water Quality Standards*

Part 3 Minimum Water Quality Criteria and Associated Uses

Regulation 3.1 Description of Contents. This part sets forth the Classes to be used by the Division in classifying the waters of the Commonwealth according to the uses for which the waters shall be enhanced, maintained and protected. For each class, the most sensitive beneficial uses are identified and minimum criteria for water quality in the water column are established. The minimum criteria in the EPA publication Quality Criteria for Water (EPA-440/9-76-023) to account for local conditions including, but not limited to:

- a) The characteristics of the biological community
- b) Temperature, weather and flow characteristics, and
- c) Synergistic and antagonistic effects of combinations of pollutants.

Regulation 3.2 Coordination with Federal Criteria. The Division will use the EPA publication entitled Quality Criteria for Water, EPA-440/9-76-023 as guidance in establishing case-by-case discharge limits for pollutants not specifically listed in these standards but included under the heading "Other Constituents" in Regulation 3.4 for identifying bioassay application factor and for interpretations of narrative criteria. Where the minimum criteria specifically listed by the Division in this part differ from those contained in the Federal criteria, the provisions of the specifically listed criteria in these standards shall apply.

Regulation 3.3 Classes and Designated Uses. The waters of the Commonwealth will be assigned to one of the classes listed below, each class is defined by the most sensitive, and therefore governing, uses which it is intended to protect. The classes are:

Classes for Inland Waters

Class A—Waters assigned to this class are designated for use as a source of public water supply.

Class B—Waters assigned to this class are designated for the uses of protection and propagation of fish, other aquatic life and wildlife; and for primary and secondary contact recreation.

Class C—Waters assigned to this class are designated for the uses of protection and propagation of fish, other aquatic life and wildlife; and for secondary contact recreation.

Classes for Coastal and Marine Waters

Class SA—Waters assigned to this class are designated for the uses of protection and propagation of fish, other aquatic life and wildlife; for primary and secondary contact recreation; and for shellfish harvesting without depuration in approved areas.

Class SB—Waters assigned to this class are designated for the uses of protection and propagation of fish, other aquatic life and wildlife; for primary and secondary contact recreation; and for shellfish harvesting with depuration (Restricted Shellfish Areas).

Class SC—Waters assigned to this class are designated for the protection and propagation of fish, other aquatic life and wildlife, and for secondary contact recreation.

Regulation 3.4 Minimum Criteria. The following minimum criteria are adopted and shall be applicable to all waters of the Commonwealth.

A. These minimum criteria are applicable to all waters of the Commonwealth, unless criteria specified for individual classes are more stringent.

<u>Parameter</u>	<u>Criteria</u>
1. Aesthetics	All waters shall be free from pollutants in concentrations or combinations that: <ul style="list-style-type: none">a) Settle to form objectionable deposits;

- b) Float as debris, scum or other matter to form nuisances;
 - c) Produce objectionable odor, color, taste or turbidity; or
 - d) Result in the dominance of nuisance species.
2. Radioactive Substances Shall not exceed the recommended limits of the United States Environmental Protection Agency's National Drinking Water Regulations.
3. Tainting Substances Shall not be in concentrations or combinations that produce undesirable flavors in the edible portions of aquatic organisms.
4. Color, Turbidity, Total Suspended Solids Shall not be in concentrations or combinations that would exceed the recommended limits on the most sensitive receiving water use.
5. Oil and Grease The water surface shall be free from floating oils, grease and petrochemicals and any concentrations or combinations in the water column or sediments that are aesthetically objectionable or deleterious to the biota are prohibited. For oil and grease of petroleum origin the maximum allowable discharge concentration is 15 mg/l.
6. Nutrients Shall not exceed the site-specific limits necessary to control accelerated or cultural eutrophication.
7. Other Constituents Waters shall be free from pollutants in concentrations or combinations that;
- a) Exceed the recommended limits on the most sensitive receiving water use;
 - b) Injure, are toxic to, or produce adverse physiological or behavioral responses in humans or aquatic life; or
 - c) Exceed site-specific safe exposure levels determined by bioassay using sensitive resident species.

Class C—Waters assigned to this class are designated for the uses of protection and propagation of fish, other aquatic life and wildlife; and for secondary contact recreation.

For Class C waters:

<u>Parameter</u>	<u>Criteria</u>
1. Dissolved Oxygen	Shall be a minimum of 5.0 mg/l in warm water fisheries and a minimum of 6.0 mg/l in cold water fisheries.
2. Temperature	Shall not exceed 83°F (28.3°C) in warm water fisheries or 68°F (20°C) in cold water fisheries, or shall the rise resulting from artificial origin exceed 4.0°F (2.2°C).
3. pH	Shall be in the range of 6.5-9.0 standard units and not more than 0.2 units outside of the naturally occurring range.
4. Fecal Coliform Bacteria	Shall not exceed a log mean for a set of samples of 1000 per 100 ml, nor shall more than 10% of the total samples exceed 2,500 per 100 ml during any monthly sampling period, except as provided in Regulation 2.1.

Class SC—Waters assigned to this class are designated for the protection and propagation of fish, other aquatic life and wildlife; and for secondary contact recreation.

For Class SC waters;

Parameter	Criteria
1. Dissolved Oxygen	Shall be a minimum of 6.0 mg/l.
2. Temperature	None except where the increase will not exceed the recommended limits on the most sensitive water use.
3. pH	Shall be in the range of 6.5-8.5 standard units and not more than 0.2 units outside the naturally occurring range.
4. Fecal Coliform Bacteria	Shall not exceed a log mean for a set of samples of 1000 MPN per 100 ml, nor shall more than 10% of the total samples exceed 2500 MPN per 100 ml during any monthly sampling period, except as provided in Regulation 2.1.

* Commonwealth of Massachusetts Water Resources Commission Division of Water Pollution Control

Table 4 Charles River Basin Water Pollution Sampling—1979

Annual Means														Geometric Mean	Fec. Col.
Station	Sample Depth ft.	T °C	Color Units	Turb. HTU	Socchi Disc ft.	Cond. Hmllos cm	Sol. p.p.t.	pH	D.O. mg/l	B.O.D. mg/l	Cl mg/l	HH ₃ -H mg/l	Tot. P. mg/l	T. Col. per 100ml	Fec. Col. per 100ml
C.R. Dam (Lower)		13	45	2.4		9,000	6	6.7	7.9	5.0	4,200	0.40	0.28	25,900	4,750
C.R. Dam (Upper)		14	55	3.0		4,500	3	6.8	9.3	3.7	2,100	0.35	0.22	11,700	1,290

Minimum—Maximum														T. Col.	Fec. Col.
Station	Sample Depth ft.	T °C	Color Units	Turb. HTU	Socchi Disc ft.	Cond. Hmllos cm	Sol. p.p.t.	pH	D.O. mg/l	B.O.D. mg/l	Cl mg/l	HH ₃ -H mg/l	Tot. P. mg/l	per 100ml	per 100ml
C.R. Dam (Lower)	23	90	4.5			21,000	13	7.0	12.6	8.6	8,700	0.90	0.40	THTC	9,100
	1	10	1.0			2,400	2	6.3	1.5	1.2	400	0.01	0.90	5,500	1,100
C.R. Dam (Upper)	25	100	5.0			14,000	8	7.0	13.1	6.7	6,700	0.74	0.74	49,500	6,000
	1	20	1.0			350	0	6.5	5.6	1.1	350	0.01	0.10	900	150

Source: Metropolitan District Commission, Environmental Quality Division, Charles River 1979, pp. 16-17.

Table 5 Concentrations of Heavy Metals in Waters of Charles River Basin

	Concentration mg/l			Applicable criterion for the protection of freshwater aquatic life(4)
	Dry Weather(1)	Wet Weather(2)	Below Harvard Bridge(3)	
Copper	0.04	0.11	0.01-0.32	0.08
Chromium	0.02	0.06	0	0.10
Lead	0.05	0.09	0.03-0.15	0.02
Zinc	0.01	0.40	0.09-0.18	0.078
Mercury	—	—	0-0.0073	0.00005
Cadmium	—	0.03	0-0.04	0.004
				(soft water)
				0.012
				(hard water)

(1) Metcalf & Eddy, Inc., November 1978. Field Survey. Average of three dry days.

(2) Metcalf & Eddy, Inc., April, 1979. Field Survey. Average of three wet days.

(3) Camp, Dresser & McKee, Inc., An Evaluation of the Removal of Salt Water from the Charles River Basin, Commonwealth of Massachusetts, Metropolitan District Commission, 1976. These values are ranges based on several depths (0-25 feet) at several stations below Harvard Bridge.

(4) U.S. EPA, Quality Criteria for Water, 1976.

Source: Metcalf & Eddy, Inc., Combined Sewer Overflow Charles River Basin Facilities Planning Area, Volume II — Environmental Assessment Report, Boston, June 13, 1980, prepared for the Metropolitan District Commission, p. 3-15.

Table 5A Heavy Metal Concentrations in Sediments in Charles River Basin

Parameter	Concentrations as mg/kg dry weight	
	Below Harvard Bridge	Below Longfellow Bridge
Iron	41,000	37,000
Manganese	330	260
Lead	1,500	1,200
Zinc	970	1,100
Nickel	150	160
Cadmium	43	46
Chromium	360	390
Arsenic	◀0.3	◀0.3
Copper	760	750
Silver	17	13
Mercury	2.4	3.7

Source: An Evaluation of the Removal of Salt Water from the Charles River Basin, Commonwealth of Massachusetts, Metropolitan District Commission, by Camp, Dresser and McKee, 1976, as referenced in Metcalf & Eddy, Inc., Combined Sewer Overflow, Charles River Basin Facilities Planning Area, Volume II — Environmental Assessment Report, Boston, June 13, 1980, prepared for Metropolitan District Commission, P. 3-17.

Table 6 Composite Water Quality Boston Inner Harbor

	Inner Harbor Range	Inner Harbor Arithmetic Mean (10 Samples)	North River Estuary Arithmetic Mean (8 Samples)
Surface Temperature(°C)	5-18*	15	16
Bottom Temperature (°C)	3-14	—	—
Dissolved Oxygen (mg/L)	2.1-5.7	4.0	8.3
Biological Oxygen Demand (mg/L)	1.1-6.8	2.9	1.7
pH	7.2-8.1	7.5	—
Total Coliform (MPN/100 ml)	930-4.6 × 10 ⁶	484,000	36
Fecal Coliform (MPN/100 ml)	91-1.5 × 10 ⁶	149,000	◀36
Suspended Solids (mg/L)	15.29	◀20	3.4
Color (SU)	15-30	22	16
Turbidity (JTU)	0-8	2.1	0
Total Alkalinity (mg/L)	45-149	108	101
Chlorides (mg/L)	6,400-18,000	14,000	11,900
Salinity (g/L)	11.7-33.1	25.8	21.9
Total Phosphorus (mg/L)	0.1-0.24	0.15	.09
Total Kjeldahl Nitrogen (mg/L)	0.6-1.8	1.2	—
Ammonia-Nitrogen (mg/L)	0.03-0.56	0.27	.45
Nitrate Nitrogen (mg/L)	0-0.	0.07	—

* Yearly range.

Source: Massachusetts Division of Water Pollution Control, 1971, 1972.

Table 7 Metals in Boston Harbor Waters

	Cadmium	Chromium	Copper	Lead	Nickel	Zinc
Inner Harbor	0.42	1.90	5.0	5.4	7.8	40.2
	ND	2.12	1.8	6.4	1.6	3.7
President Roads	0.46	0.5	5.2	2.0	8.2	11.6
	ND	3.2	1.6	3.5	1.9	7.5
Dorchester Bay	0.24	0.3	2.6	2.0	4.7	11.2
	ND	4.5	0.8	2.4	1.8	1.7
Thompson-Long	0.20	0.5	2.2	1.9	6.8	9.0
Island Area	ND	1.3	1.5	1.7	1.3	1.8

Source: Gilbert, T., et al., 1972

All values mg/l

First value soluble phase

Second value particulate phase (solids greater than 1μ)

ND=Not Determined

Table 7A Metals in Boston Harbor Sediments

	Cadmium	Chromium	Copper	Lead	Nickel	Zinc
Deer Flats	6.7	213.8	120.5	97.0	37.8	231.2
Dorchester Bay	5.3	132.9	85.1	106.0	31.4	199.4
Thompson-Long						
Island Area	4.3	126.0	93.6	122.3	25.3	296.0
Quincy	4.0	212.0	143.0	129.0	35.4	223.4
Hingham Bay	2.2	81.6	67.0	108.3	24.5	128.0
Area East of						
Long Island	3.7	109.3	88.6	87.8	27.6	145.6

Source: Gilbert, T., et al., 1972

All values are averages in mg/l for surface sediment layer.

*Source: Environmental Protection Agency, Draft Environmental Impact Statement on the Upgrading of the Boston Metropolitan Area Sewerage System, Boston, Massachusetts, 1978.

Table 8 Alternatives for Control of Combined Sewer Overflows

A. SOURCE CONTROLS (Best Management Practices)Quality Control Measures

1. Solid waste management
2. Street sweeping
3. Control of fertilizer and pesticide use
4. Snow removal and deicing controls
5. Soil erosion control
6. Control of runoff from commercial/industrial areas
7. Animal waste removal
8. Sewer line flushing
9. Catch basin cleaning

Quantity Control Measures

1. Porous pavement
2. Flow detention measures (ponding)
3. Roof-top storage
4. Disconnect area drains and roof-leaders

B. COLLECTION SYSTEM CONTROLS

1. Sewer separation
2. Infiltration/inflow control
3. Polymer injection to increase hydraulic capacity
4. Regulating devices
5. Remote monitoring and control
6. Flow diversion

C. STORAGEIn-line Storage

1. Inflatable dams
2. Automotive valves and gates

Off-line Storage

1. Storage-tanks
2. Lagoons
3. Deep tunnels
4. Abandoned pipelines

D. PHYSICAL TREATMENT

1. Sedimentation
2. Dissolved air flotation
3. Screens

E. BIOLOGICAL TREATMENT

1. Contact stabilization
2. Trickling filters
3. Rotating biological contractors
4. Treatment lagoons
5. Land application

F. PHYSICAL-CHEMICAL TREATMENT

1. Chemical clarification
2. Filtration
3. Carbon absorption

G. DISINFECTION

1. Chemical
2. Physical
3. Mechanical

Source: Kolb, Madeleine, Department of Environmental Quality Engineering, Wastewater Management Planning for Boston Harbor: A Status Report, prepared for the Boston Harbor Interagency Coordinating Committee, Boston, August 1980.

Table 9 Yearly Average* Equivalent Sound Levels Identified as Requisite to Protect the Public Health and Welfare with an Adequate Margin of Safety

	Measure	Indoor Activity Interference	Hearing Loss Consideration	To Protect Against Both Effects (b)	Outdoor Activity Interference	Hearing Loss Consideration	To Protect Against Both Effects (b)
Residential with Outside Space and Farm Residences	L _{dn} L _{eq} (24)	45	70	45	55 70		55
Residential with No Outside Space	L _{dn} L _{eq} (24)	45	70	45			
Commercial	L _{eq} (24)	(a)	70	70(c)	(a)	70	70(c)
Inside Transportation	L _{eq} (24)	(a)	70	(a)			
Industrial	L _{eq} (24)(d)	(a)	70	70(c)	(a)	70	70(c)
Hospitals	L _{dn} L _{eq} (24)	45	70	45	55 70		55
Educational	L _{eq} (24) L _{eq} (24)(d)	45	70	45	55 70		55
Recreational Areas	L _{eq} (24)	(a)	70	70(c)	(a)	70	70(c)
Farm Land and General Unpopulated Land	L _{eq} (24)				(a)	70	70(c)

Code:

(a) Since different types of activities appear to be associated with different levels, identification of a maximum level for activity interference may be difficult except in those circumstances where speech communication is a critical activity. (See Figure D-2 for noise levels as a function of distance which allow satisfactory communication.)

(b) Based on lowest level.

(c) Based only on hearing loss.

(d) An L_{eq}(8) of 75 dB may be identified in these situations so long as the exposure over the remaining 16 hours per day is low enough to result in a negligible contribution to the 24-hour average, i.e., no greater than an L_{eq} of 60 dB

Note: Explanation of identified level for hearing loss: The exposure period which results in hearing loss at the identified level is a period of 40 years.

*Refers to energy rather than arithmetic averages.

Source: Environmental Protection Agency Office of Noise Abatement and Control, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare With an Adequate Margin of Safety, March, 1974.

Table 10 Excerpt from Beaufort Wind Scale

Force	Description	Hourly Average Wind Speeds/ Approximate Effective Gust Speeds (mph)*		Specifications
		Value	Value Range	
2	Light Breeze to Gentle Breeze	4	3-6	Wind felt on faces; leaves rustle
3	Gentle Breeze	8	6-10	Leaves and small twigs in constant motion; wind extends light flag
4	Moderate Breeze	12	10-15	Raises dust and loose paper; small branches are moved
5	Fresh Breeze	17	15-20	Small trees in leaf begin to sway
6	Strong Breeze	22	19-25	Large branches in motion whistling heard in tele- phone wires; umbrellas used with difficulty
7	Moderate Gale	28	25-31	Whole trees in motion; inconvenience felt when walking against wind
8	Gale	34	31-38	Breaks twigs off trees; generally impedes progress

* Hourly average wind speeds are given in miles per hour for a pedestrian reference height of two meters (six feet). These speeds have been adjusted downward by about twenty percent from the Beaufort Scale which originally reflected a reference height of ten meters (about thirty feet) in an open area. The adjusted hourly averages approximate the effective gust speeds in an urban area.

Table 11 Pedestrian Safety/Comfort Standards for Urban Winds

Activity Area	One-Hour Average Wind Velocity	Permitted Occurrence Frequency	Effective Gust Velocity*
All Pedestrian Areas Limit for Safety	20 mph	0.1%	35.6 mph
Major Walkways, especially Principal Egress Path in the Vicinity of High-Rise Buildings	20 mph	0.1%	35.6 mph
Major Walkways, especially Principal Egress Path Vicinity High-Rise Buildings	17.4 mph**	1%	30.5 mph**
Other Pedestrian Walkways including Street and Arcade Shopping Areas	14.4 mph	5%	25 mph
Open Plazas and Park Areas, Walking, Strolling Activities	8 mph	15%	14.1 mph
Open Plaza and Park Sitting Areas, Open-Air Restaurants	5 mph	20%	9 mph

* Modified criteria of Cohen, et al., to indicate corresponding effective gust speeds.

** Interpolated from original comfort criteria of Cohen, et al.

Source: Cohen, H. et al., "Pedestrians and Wind in the Urban Environment," University of Massachusetts, Institute for Man and Environment, UMASS/IME/R-77/13 (1977).

Table 1 Boston Employment by Industry 1982

Industry	1982 Employment in Boston	Office Employment as a Percent of Total	1982 Office Employment
Agriculture/Mining	544	13.8	75
Construction	10,422	19.8	2,058
Manufacturing	49,667	10.3	5,096
TCPU*	35,882	70.4	25,265
Wholesale & Retail Trade	80,288	5.3	4,255
FIRE**	76,720	68.1	52,216
Service	192,900	30.2	58,179
Business	57,870	31.7	18,345
Professional	135,030	29.5	39,834
Government	87,817	19.3	16,984
Proprietors	11,965	41.8	5,005
TOTAL	546,205	31.0	169,133

* Transportation, Communications, and Public Utilities.

** Finance, Insurance, and Real Estate.

Source: Mass. Division of Employment Security, ES-202 file for Boston and Suffolk County; U.S. Department of Commerce, Bureau of Economic Analysis.

Table 2 Projected Growth of Office Space and Employment in Boston 1982-1992

	Increase in Boston Employment	Office Employment as Percent of Total by Industry	Increase in Office Employment	Square Feet of Office Space Per Employee	Increase in Office Space Requirements
Agriculture/Mining	11	15.2	2	198.6	397
Construction	2,282	21.7	495	198.6	98,307
Manufacturing	4,655	11.3	526	270.7	142,388
TCPU*	3,754	77.5	2,909	106.1	308,645
Trade	11,976	5.8	695	289.9	201,481
FIRE**	15,888	74.9	11,900	246.4	2,932,160
Services	51,630	46.2	23,853	246.7	5,884,535
Government	4,491	21.2	952	162.9	155,081
Proprietors	-1,782	46.0	-820	0	0
TOTAL	92,905		40,512		9,722,994

* Transportation, Communications, and Public Utilities.

** Finance, Insurance, and Real Estate.

Source: Boston Redevelopment Authority.

Table 3 Employment in Boston, 1976 & 1982, Actual, and 1992 Projected (Number of Workers)

	Actual 1976	Projected 1982	Change 1992	1976-82	1982-92	Annual Rate of Change 1976-82	1982-92
Agriculture, Mining	791	544	555	- 247	+ 11	-5.2%	1.6%
Construction	9,003	10,422	12,704	+ 1,419	+ 2,282	2.6	2.0
Manufacturing	53,385	49,667	54,322	- 3,718	+ 4,655	-1.2	0.9
Transportation/ Communication/ Public Utilities	34,131	35,882	39,636	+ 1,754	+ 3,754	0.9	1.0
Trade	84,627	80,288	92,264	- 4,339	+ 11,976	-0.9	1.4
Finance/Insurance/ Services	62,229	76,720	92,608	+ 14,491	+ 15,888	3.9	1.9
Government	160,902	192,900	244,530	+ 31,998	+ 51,630	3.3	2.4
Proprietors	85,048	87,817	92,308	+ 2,769	+ 4,491	0.5	0.5
	10,560	11,965	10,183	+ 1,405	- 1,782	2.2	-1.6
TOTAL	500,676	546,205	639,110	+ 45,529	+ 92,905	1.5%	1.6%

Sources: Massachusetts Division of Employment Security, ES-202 file for Boston and Suffolk County; U.S. Department of Commerce, Bureau of Economic Analysis.

Estimates for 1982 are preliminary. Projections for 1992 by Boston Redevelopment Authority, based, in part, on projections of the U.S. Department of Labor and the Massachusetts Division of Employment Security, for the Nation and State, respectively; see Boston Redevelopment Authority, *Boston's Projected Employment in the 1980's: Services, Information, and High Technology Industries Lead to a Resurgence of Job Opportunities*, January 1983.

Table 4 City of Boston Employment Projections by Detailed (2-Digit SIC) Industries, 1980-1990 (Number of Workers)

SIC Code	Industry	Boston 1980 Actual	Boston 1990 Projected	Change	
				Number	Percent
TOTAL		548,497	631,517	+ 83,020	+ 15.1
Agricultural, Forest, Fisheries		518	528	+ 10	+ 2.1
01	Agriculture-Corps	81	83	+ 2	+ 1.9
02	Agriculture-Livestock	0	0	0	0
07	Agricultural Services	394	401	+ 7	+ 2.7
08	Forestry	0	0	0	0
09	Fisheries	43	44	1	+ 2.7
Mining		45	45	0	0
Construction		10,163	12,446	2,283	+ 22.5
15	General Building	2,748	3,331	+ 583	+ 21.2
16	General Contracting	1,165	1,421	+ 256	+ 22.0
17	Special Contracting	6,250	7,694	+ 1,444	+ 23.1
Manufacturing		51,861	56,529	+ 4,668	+ 9.0
Durable Goods		20,615	25,130	+ 4,515	+ 21.9
24	Lumber & Wood	243	266	23	+ 9.6
25	Furniture & Fixtures	885	838	- 47	- 5.5
32	Stone, Clay, & Glass	342	341	- 1	- 0.4
33	Primary Metals	766	806	+ 40	+ 5.2
34	Fabricated Metals	6,970	8,489	+ 1,519	+ 21.8
35	Non-Electric Machinery	4,221	5,808	+ 1,587	+ 19.6
36	Electrical Equipment	2,296	1,859	+ 563	+ 21.2
37	Transportation Equipment	960	1,036	+ 76	+ 7.9
38	Instruments	2,364	3,146	+ 782	+ 33.1
39	Miscellaneous Manufacturing	1,568	1,541	- 27	- 1.7
Non-Durable Goods		31,246	31,399	+ 325	+ .5
20	Food Products	5,635	5,489	- 146	- 2.6
21	Tobacco Products	0	0	0	0
22	Textile Products	629	579	- 50	- 8.0
23	Apparel & Accessories	7,636	7,407	- 229	- 3.0
26	Paper & Pulp	1,121	1,083	- 38	- 3.4
27	Printing & Publishing	11,384	11,623	+ 239	+ 2.1
28	Chemical & Related Goods	2,202	2,550	+ 348	+ 15.8
29	Petroleum & Coal	248	255	+ 7	+ 2.7
30	Rubber & Plastics	1,143	1,403	+ 260	+ 22.7
31	Leather Products	1,248	1,010	- 238	- 19.1

Table 4 (Continued)

SIC Code	Industry	Boston 1980 Actual	Boston 1990 Projected	Change	
				Number	Percent
Transportation/Communications/		36,660	40,569	+ 3,909	+ 10.6
40	Railroad Transportation	0	0	0	0
41	Local Passenger Transportation	1,924	1,787	- 137	- 7.1
42	Trucking and Warehousing	3,902	3,836	- 66	- 1.7
44	Water Transportation	1,220	1,220	0	0
45	Air Transportation	8,963	8,246	- 717	- 8.0
46	Pipeline Transportation	0	0	0	0
47	Transportation Services	1,917	2,561	+ 644	+ 33.6
48	Communication	13,961	17,926	+ 3,965	+ 28.4
49	Electric, Gas, and Sanitary	4,773	4,993	+ 220	+ 4.6
Trade		83,027	95,121	+ 12,094	+ 14.6
	Wholesale Trade	27,308	30,611	+ 3,303	+ 12.1
50	Durable Goods	13,636	15,927	+ 2,291	+ 16.8
51	Non-Durable Goods	13,672	14,684	+ 1,012	+ 7.4
Retail Trade		55,719	64,510	+ 8,791	+ 15.8
52	Building Materials	826	871	+ 45	+ 5.5
53	General Merchandise	8,089	8,501	+ 412	+ 5.1
54	Food Stores	7,543	7,988	+ 445	+ 5.9
55	Automotive and Service	2,727	2,752	+ 25	+ .9
56	Apparel and Accessory	5,116	5,546	+ 430	+ 8.4
57	Furniture and Fixtures	1,784	1,910	+ 126	+ 7.1
58	Eating and Drinking	21,203	17,373	+ 6,170	+ 29.1
59	Miscellaneous Retail	8,431	9,569	+ 1,138	+ 13.5
Finance, Insurance, Real Estate		70,451	85,028	+ 14,577	+ 20.7
60	Banking	17,443	30,291	+ 2,948	+ 16.9
61	Credit Institutions	2,186	3,157	+ 971	+ 44.4
62	Security Brokers	7,782	11,237	+ 3,455	+ 44.4
63	Insurance Carriers	28,576	31,576	+ 3,000	+ 10.5
64	Insurance Services	4,977	5,818	+ 841	+ 16.9
65	Real Estate	8,105	11,039	+ 2,934	+ 36.2
66	Other Insurance & Real Estate	209	268	+ 59	+ 28.2
67	Holding and Investment Cos.	1,173	1,542	+ 369	+ 31.5
Services		187,991	239,267	+ 51,276	+ 27.3
	Business and Personal	54,994	73,713	+ 18,719	+ 34.0
70	Hotel and Lodging	5,974	8,053	+ 2,079	+ 34.8
72	Personal Services	4,127	4,185	+ 58	+ 1.4
73	Business and Advertising	35,205	50,977	+ 15,772	+ 44.8
75	Auto Repair and Services	4,371	4,891	+ 520	+ 11.9
76	Miscellaneous Repair	1,047	1,188	+ 141	+ 13.5
78	Motion Pictures	1,451	1,541	+ 90	+ 6.2
79	Amusement & Recreation	2,819	2,878	+ 59	+ 2.1
Professional		132,997	165,554	+ 32,557	+ 24.5
80	Health and Hospitals	59,776	76,812	+ 17,036	+ 28.5
81	Legal Services	8,362	11,473	+ 3,111	+ 37.2
82	Educational Services	24,112	23,750	- 362	- 1.5
83	Social Services	12,648	17,366	+ 4,718	+ 37.3
84	Museums and Gardens	1,407	1,749	+ 342	+ 24.3
86	Membership Organizations	5,617	5,645	+ 28	+ 0.5
88	Private Household Workers	437	444	+ 7	+ 1.5
89	Miscellaneous Professional	20,638	28,315	+ 7,677	+ 37.2
	Engineering/Architectural/ Research/Auditing				
Proprietors (Self-Employed)		11,764	10,000	- 1,764	- 15.0
Government (Federal, State, Local)		96,017	91,984	- 4,033	- 4.2

Source and Methodology:

Compiled by Boston Redevelopment Authority using projections of U.S. industry employment growth 1980-1990 from Valerie Personick, "The Outlook for Industry Output and Employment through 1990," *Monthly Labor Review*, August 1981, pp. 28-41, and Massachusetts projections of industry employment prepared by the Massachusetts Division of Employment Security, "Massachusetts Employment: Projected Changes 1980 to 1990," October 1982. Boston projects were made at the detailed (2-digit SIC) industry level, taking the lower of the growth rates from the national and state projections (usually Massachusetts rates) except for a selection of about 20 (2-digit SIC) industries which give reasonable evidence of being fast-growth industries for Boston over the 1980-1990 time period. Thus, the Boston projection series is a "high growth scenario," and compares with an alternative moderate growth scenario of 60,000 net new jobs for the period.

Table 5 Occupations of Employed Boston Residents 1950-1980

	1980 (age 16 and over)		1970		1960 (age 14 and over)		1950	
All employed persons	256,047	100%	266,505	100%	288,246	100%	311,855	100%
Professional, technical & managerial*	78,144	31	60,035	23	49,080	17	56,370	18
Sales	18,788	7	150,073	6	18,401	6	26,472	8
Clerical	58,451	23	71,655	27	58,990	20	60,557	19
Craftsmen & foremen	19,772	8	27,157	10	32,398	11	42,012	13
Operatives, including transportation equipment operatives	24,825	10	36,695	14	52,175	18	61,177	20
Laborers, including farm	8,958	3	11,202	4	12,003	4	17,892	6
Service workers, including private household	47,109	18	44,688	17	38,084	13	44,999	14
Not reported	-	-	-	-	27,115	9	2,798	1

* Includes farms

** May not total exactly, due to rounding

Sources: 1950, 1960, 1970, and 1980 U.S. Census of Population and Housing

Table 6 Boston Employment Trends Downtown, City and Metropolitan Area

Year	Downtown	City of Boston	Metropolitan Area
1960	237,000	531,000	1,074,700
1970	256,000	552,000	1,264,700
1975	265,000	507,000	1,259,800
1980	290,000	548,500	1,473,600
1982	290,000	546,000	1,493,000

* Central Business District and Back Bay.

Source: Boston Redevelopment Authority.

Downtown—BRA Update from urban renewal studies, includes CBD and Back Bay.

City—BEA regional economic information system.

Metropolitan Area—Bureau of Labor Statistics, 790 Series.

Table 1 Central Boston Development Part I: 1975-1982

1975	Office	Location	Magnitude	Tax Status
	Stone & Webster	245 Summer	910,000 sf	Tax
	Hancock Tower	200 Clarendon Street	2,000,000 sf	Tax
	Shawmut Bank	One Federal Street	1,103,000 sf	Tax
	50 Stanford Street	Government Center	200,000 sf	Tax
	Blue Cross-Blue Shield Building	100 Summer Street	1,000,000 sf	Mixed
1975	Retail			
Rehab	Kennedy's	Summer and Hawley Streets	40,000 sf	Tax
Rehab	Exeter Theatre & Restaurant	Newbury and Exeter Streets	26,000 sf	Tax
	Tufts Garage	South Cove	20,000 sf	Tax
1975	Medical			
	B.U. Medical Center, Dental School	South End	99,000 sf	Exmpt
1975	Cultural			
	Whites of their Eyes			Tax
Rehab	Bunker Hill Commission Museum			Exmpt
Rehab	Berklee Performance Center	Massachusetts Avenue		Pilot
Rehab	Boston Repertory Theatre	Baylston Place		Exmpt
	Where's Boston	Prudential Center/60 State Street		Tax
1975	Industrial			
	New England Nuclear	Albany Street/South End	105,000 sf	Pilot
1975	Hotel			
	Sheraton Addition	Prudential Center	428 Rooms	Tax
1975	Residential			
Rehab	Larkin House R-71		6 du	23
	X-44 Austin/Lawrence		7 du	Tax
	Amy Lowell House	West End	152 du	Tax
Rehab	Chauncy House	Chinatown	87 du	121A
Conv.	Vendome Hotel Conversion		120 du	Tax
1976	Office			
	Charlestown Savings Bank	55 Summer Street	140,000 sf	121A
1976	Retail			
Rehab	Quincy Market Building	Faneuil Hall Marketplace	75,000 sf	Pilot
1976	Medical			
	Beth Israel Feldberg Building	Medical Area	176,490 sf	Exmpt
	Massachusetts Eye & Ear Phase II	West End	133,610 sf	Exmpt
	Deaconess, Kennedy Building	Medical Area	78,500 sf	Exmpt
1976	Educational			
	Northeastern University/ Stearns Building		32,500 sf	Exmpt
1976	Cultural			
Rehab	Old State House/Faneuil Hall	Government Center	\$2,000,000	Exmpt
Rehab	National Park Service Headquarters	15 State Street		Exmpt
Rehab	Ironsides National Park			Exmpt
1976	Residential			
Conv.	Battery/Camm. Conversion	North End	34 du	Tax
Rehab	Chin Housing R-60		16 du	Tax
	Charles River Park D	West End	710 du	Tax
	R-4 Quincy Towers	South Cove	96 du	121A
Conv.	Mercantile Wharf	Waterfront	121 du	121A
	Parcel C-2 Elderly (BHA)	Waterfront	110 du	Exmpt

1977	Office			
Rehab	77 N. Washington Street	North End	110,000 sf	Tax
	Fiduciary Trust Building	175 Federal Street	200,000 sf	121A
	60 State Street	Government Center	823,000 sf	Tax
Rehab	South Market Building	Quincy Market	90,000 sf	Pilot
1977	Retail			
Rehab	Waterfront (Scattered Sites)	Waterfront	50,000 sf	Tax
	Shawmut Bank Retail	1 Federal Street	10,000 sf	Tax
Rehab	South Market Building	Quincy Market	80,000 sf	Pilot
1977	Residential			
	C-2-B Elderly (Ansonia House Assoc.)	Waterfront	151 du	121A
1978	Office	Location	Magnitude	Tax Status
Rehab	Ten Past Office Square		210,000 sf	Tax
Rehab	7 Water Street		40,000 sf	Tax
Rehab	North Market Building	Quincy Market	80,000 sf	Pilot
Rehab	Thompson Square		10,000 sf	Tax
Rehab	Sherman's & Osca Drug		40,000 sf	Tax
Rehab	Barnes & Noble	Washington Street	20,000 sf	Tax
	Charlestown Shopping Mall		80,000 sf	Tax
	Jordan Marsh Redesign		300,000 sf	121A
Rehab	"The Corner" (Formerly Gilchrist)	431-439 Washington Street	65,000 sf	Tax
Rehab	North Market Building	Quincy Market	60,000 sf	Pilot
1978	Medical			
	Sidney Farber Cancer Institute		400,000 sf	Exmpt
1978	Educational			
	Bunker Hill Comm. College/ Library & Cafe		127,000 sf	Exmpt
1978	Cultural			
Rehab	Boston Shakespeare Co./ Horticultural Hall	Massachusetts and Huntington Avenues		Exmpt
Rehab	Opera Company of Boston (Savoy)	539 Washington Street		Tax
Rehab	Next Move Theatre	Boylston Place		Tax
Rehab	Modern Theatre	523 Washington Street		Tax
1978	Industrial			
Rehab	Teradyne Corporation	South Station/Leather District	160,000 sf	Tax
Rehab	Brasswell, Caldaz; Bldg. 18, 32 53 (EDIC)	BMIP	570,000 sf	Pilot
Rehab	Arabian Coffee Co. (EDIC)	385 Summer Street	43,100 sf	Tax
1978	Residential			
	Symphony Towers East & West		404 du	121A
Rehab	42 Mt. Vernon Street		13 du	Tax
Rehab	101 Mt. Vernon Street Cando.		5 du	Tax
	South End Settlement		15 du	Tax
Rehab	Children's Services		6 du	Tax
	East Coast Development	Waterfront	23 du	Tax
	Casas Barinquen (Barinquen Assoc.)		36 du	121A
Rehab	Blackstone School	West End	176 du	121A
Rehab	Bowdoin School		35 du	121A
Rehab	Franklin Square House (St. James Assoc.)		182 du	121A

1979	Office				
Rehab	One McKinley Square		36,000 sf	Tax	
Rehab	Chadwick Leadworks Building	184 High Street	53,100 sf	Tax	
Rehab	United Way Building	87 Kilby Street	63,800 sf	Tax	
Rehab	10 Past Office Square		177,000 sf	Tax	
Rehab	100 Franklin Street		100,000 sf	Tax	
Rehab	18 Tremont Street		181,000 sf	Tax	
Rehab	Anderson Park		6,000 sf	121A	
1979	Retail				
Rehab	226-232 Newbury Street		7,000 sf	Tax	
Rehab	Park Square Building Arcade		50,000 sf	Tax	
	Northeastern Dormitory		390 Beds	Pilot	
1979	Cultural				
Conv.	Museum Wharf	Fort Point Channel		Agree	
	Aquarium Park	Waterfront		Exmpt	
Rehab	Institute of Contemporary Art			Pilot	
1979	Industrial				
Rehab	Job Training Center, Bldg. 49 (EDIC)	BMIP	43,600 sf	Pilot	
Rehab	Chadis Printing (EDIC)	BMIP	36,000 sf	Pilot	
Rehab	Leonard Silver (EDIC)	BMIP	148,000 sf	Pilot	
1979	Cultural				
Rehab	Schubert	Theatre District	1,500 Seats	Tax	
1979	Industrial				
Rehab	PX Engineering, Building 31 (EDIC)	BMIP	85,000 sf	Pilot	
1979	Hotel				
Rehab	Sheraton Boston	Prudential Center	900 Rooms	Tax	
1979	Residential				
	Exeter Towers		96 du	121A	
	Casa Maria	North End	75 du	121A	
Conv.	Anderson Park Apt. Conversion		89 du	121A	
Rehab	San Marca Conda Conversion	North End	60 du	Tax	
Rehab	55-65 North Washington Street	North End	16 du	Tax	
Rehab	226-232 Newbury Street		24 du	Tax	
Conv.	McLaughlin Elevator Factory	North End	28 du	Tax	
Rehab	Hemenway Apartments	Hemenway St. & Huntington Ave.	183 du	121A	
1980	Office	Location	Magnitude	Tax Status	
Rehab	27 State Street		21,000 sf	Tax	
	37 Newbury Street		8,200 sf	Tax	
Rehab	33 Broad Street		38,800 sf	Tax	
Rehab	126 Newbury Street		27,000 sf	Tax	
Rehab	Paine Furniture Building	6 St. James Avenue/Park Square	280,000 sf	Tax	
Rehab	120-130 Water Street		10,000 sf	Tax	
1980	Retail				
	37 Newbury Street		2,500 sf	Tax	
	Exeter Towers		12,000 sf	121A	
Rehab	Back Bay Racquet Club	Columbus Avenue	28,000 sf	Tax	
Rehab	Eddie Bauer	510 Boylston Street	15,000 sf	Tax	
Rehab	Stearns Building	140 Tremont Street	8,000 sf	Tax	
Rehab	Commercial Block	Waterfront	1,800 sf	121A	
	Brigham & Women's Hospital Center & Lab	Medical Area	800,000 sf	Exmpt	
	Materials Handling Center (Service Center)	Medical Area	60,500 sf	121A	

1980	Educational			
Rehab	New England School of Law	Stuart Street; Park Square	56,000 sf	Pilot
1980	Cultural			
Rehab	Metrapalitan Center Stage-House (Phase 1)	Theatre District	4,200 Seats	Pilot
1980	Industrial			
Rehab	Artco Offset (EDIC)	BMIP	35,780 sf	Pilot
Rehab	Lappin Wallpaper (EDIC)	BMIP	35,780 sf	Pilot
Rehab	Calder, Leon, Silin, Carona (EDIC)	BMIP	168,755 sf	Pilot
1980	Residential			
Conv.	Commerical Block	Waterfront	34 du	121A
Rehab	Stearns Building	140 Tremont Street	140 du	121A
Conv.	Harvard School Conv. (Chtwn. Ec. Dev. Co.)		30 du	121A
Conv.	Masan Place Elderly (Herald Building)		129 du	121A
Rehab	Petersborough Street Housing		220 du	121A
Conv.	Charles Perkins School		16 du	Tax
Rehab	Adams Nevine Condo Conversion		44 du	Tax
Conv.	Union Wharf Condo Conversion	Waterfront	59 du	Tax
	Union Wharf Condo Townhouses	Waterfront	27 du	Tax
1981	Office			
	Old Federal Reserve Site	One Post Office Square	740,000 sf	Tax
	50 Milk Street		250,000 sf	Tax
Rehab	Harbor Plaza (Sheraton Building)	470 Atlantic Avenue/Waterfront	335,000 sf	Tax
Rehab	Parcel 13	Boylston Street	4,300 sf	Tax
Rehab	N.E. Telephone Building	245 State Street/Waterfront	217,000 sf	Tax
Rehab	190 High Street		10,000 sf	Tax
Rehab	161 Devonshire Street		55,000 sf	Tax
Rehab	54 Kilby Street		2,000 sf	Tax
Rehab	Eldredge Building	376 Baylston Street	20,000 sf	Tax
Rehab	Salada Tea/Berkely Place	155 Berkely Street	103,000 sf	Tax
Rehab	1 Bramfield Street		16,500 sf	Tax
Rehab	268 Summer Street (SAFDI)	Fort Point Channel	67,000 sf	Tax
Rehab	195 State Street		24,000 sf	Tax
Conv.	The Corner (Formerly Gilchrist)	431-439 Washington Street	46,200 sf	Tax
Rehab	889 Baylston Street		16,000 sf	Tax
Rehab	530 Atlantic Avenue (Russia Wharf)	Fort Point Channel	94,500 sf	Tax
Rehab	International House	125-131 Pearl Street	33,000 sf	Tax
1981	Retail			
	Old Federal Reserve Site	One Post Office Square	20,000 sf	Tax
	Dock Square Garage	Quincy Market	17,000 sf	Tax
	50 Milk Street		11,000 sf	Tax
Rehab	Eldrege Building	376 Baylston Street	17,000 sf	Tax
Rehab	161 Devonshire Street		5,500 sf	Tax
Rehab	126 Newbury Street		6,000 sf	Tax
Rehab	195 State Street		3,500 sf	Tax
Rehab	The Corner (Formerly Gilchrist)	431-439 Washington Street	13,200 sf	Tax
Rehab	889 Baylston Street		4,000 sf	Tax
1981	Medical			
	Mass. General Ambulatory Care Center	West End	287,000 sf	Exmpt
	Medical Area Energy Plant	Medical Area		121A
1981	Educational			
Rehab	Suffolk University	Samerset Street	129,000 sf	Pilot

1981	Cultural	Location	Magnitude	Tax Status
	Museum of Fine Arts West Wing	Huntington Avenue	80,000 sf	Exmpt
Rehab	Museum of Fine Arts White Wing	Huntington Avenue	52,000 sf	Exmpt
1981	Transportation			
	Conv. Bldg. 40 Charlestown Navy Yard		362 Cars	121A
1981	Industrial			
Rehab	Pier 5 (EDIC)	BMIP		Pilot
	Water and Fire Systems (EDIC)	BMIP		Pilot
Rehab	Acme Bookbinding (EDIC)	100 Cambridge Street	22,000 sf	Tax
	Jessam Corporation (EDIC)	349-351 Newbury Street	1,300 sf	Tax
Rehab	Jessam Corporation (EDIC)	349-351 Newbury Street	9,222 sf	234
Rehab	Costa Fruit & Produce (EDIC)	414 Rutherford Ave.	73,000 sf	Tax
	Pier VII Corp. (EDIC)	BMIP	17,000 sf	Pilot
Rehab	Colonial Paper Co. (EDIC)	440 Rutherford Ave.	51,000 sf	Tax
Rehab	Allen Stationary (EDIC)	171A Mass. Ave.	10,000 sf	Tax
Rehab	Spaulding Co. (EDIC)	BMIP	35,800 sf	Pilot
Rehab	Central Ship (EDIC)	BMIP	140,900 sf	Pilot
Rehab	Turner Construction (EDIC)	BMIP	36,100 sf	Pilot
1981	Hotel			
Conv.	Meridien	One Post Office Square	330 Rooms	Tax
	Ritz-Carlton Addition	Arlington Street	80 Raams	Tax
Rehab	Parker House		300 Rooms	Tax
1981	Residential			
Rehab	St. Botolph Terrace	351-367 Mass. Avenue	52 du	121A
Rehab	Parcel 13 (MBH Assac.)	Baylston Street	44 du	121A
	Ritz-Carlton Condos	Arlington Street	53 du	Tax
Conv.	15, 29, & 33 Sleeper St.	Fort Point Channel	88 du	Tax
	Westland Avenue Associates		97 du	121A
Conv.	Constitution Quarters (Bldg. #42)	Charlestown Navy Yard	367 du	121A
1982	Office			
Rehab	88 Broad Street		65,000 sf	Tax
Rehab	10 Liberty Square	55 Kilby Street	18,000 sf	Tax
Rehab	286 Congress Street (Russia Wharf)	Fort Point Channel	150,000 sf	Tax
Rehab	270 Congress Street (Russia Wharf)	Fort Point Channel	65,100 sf	Tax
Rehab	Church Green I		53,000 sf	Tax
Rehab	148-150 Tremont Street		120,000 sf	Tax
Rehab	Transcript-Past Building	1 Milk Street	44,500 sf	Tax
Rehab	99 Bedford Street		84,000 sf	Tax
Conv.	355 Comm. Ave. (Gov. Ames Mansion)		34,000 sf	Tox
Rehab	26 West Street		26,000 sf	Tax
Rehab	126 High Street		30,000 sf	Tax
Rehab	Park Square Building		500,000 sf	Tax
Rehab	Stuart Building	380 Stuart Street	142,000 sf	Tax
Rehab	Rasebud Building (Lewis Wharf)	Waterfront	16,800 sf	Tax
Rehab	Merchants Building	77 Summer Street	38,000 sf	Tax
Rehab	Walker Building (Parsans Brinkerhof)	120 Baylston Street	160,000 sf	Tax
Rehab	76 Summer Street		19,000 sf	Tax
Rehab	45 Bromfield Street		19,000 sf	Tax
Rehab	Burbury af London	Arlington, Newbury Streets	1,660 sf	Tax
Rehab	10 Winthrop Square	Financial District	23,000 sf	Tax
Rehab	63 Chatham Street	Quincy Market Area	8,700 sf	Tax
Rehab	Oliver Building	2 Oliver Street	212,000 sf	Tax

1982	Retail			
	Long Wharf Hotel	Waterfront	10,000 sf	121A
Rehab	Park Square Building		40,000 sf	Tax
Rehab	Church Green		20,000 sf	Tax
Rehab	Walker Building (Parsons Brinkerhof)	120 Baylston Street	30,000 sf	Tax
Rehab	Burbury of London	Arlington, Newbury Streets	6,000 sf	Tax
1982	Medical			
	N.E. Medical Center Pediatric Hospital		150,000 sf	Pilot
	Tufts Nutrition Center	Washington, Stuart Streets	214,000 sf	Exmpt
	Mass. Rehab Hospital Addition	North Station	32,096 sf	Tax
Rehab	N.E. Medical Center, Shuffle Space	Pratt, Farnsworth, Prager	28 Beds	Exmpt
1982	Educational			
Rehab	Berklee School of Music	1050 Boylston Street	10,000 sf	Exmpt
1982	Cultural			
	Shipyards Quarters Marina Phase I	Charlestown Navy Yard	148 Slips	121A
Rehab	Museum of Fine Arts Asiatic Wing	Huntington Avenue	100,000 sf	Exmpt
Rehab	Wilbur Theatre	Theatre District	1,237 Seats	Tax
1982	Transportation			
	One Post Office Square		400 Cars	Tax
1982	Industrial	Location	Magnitude	Tax Status
Rehab	Fargo Bldg./Barnes Complex (U.S. Army)	Summer Street	422,500 sf	Exmpt
	McDonald Steel (EDIC)	BMIP	11,000 sf	Pilot
	Turner Fisheries Inc. (EDIC)	Commonwealth Flats	15,000 sf	Tax
	Merchants Tire Co. (EDIC)	1299 Boylston Street	25,000 sf	Tax
Rehab	Merchants Tire Co. (EDIC)	1299 Boylston Street	75,000 sf	Tax
Rehab	General Electric (EDIC)	BMIP	40,000 sf	Pilot
Rehab	11 Daly-Bldg 18 (EDIC)	BMI	86,000 sf	Pilot
1982	Hotel			
Rehab	Sheraton Boston	Prudential Center	428 Rooms	Tax
	Bastonian	Quincy Market	155 Rooms	Tax
	Marriott Long Wharf	Waterfront	395 Rooms	Tax
	Hilton	Dalton Street	372 Rooms	Tax
1982	Residential			
Rehab	Wait Street Associates	Mission Hill	100 du	121A
Rehab	Frankie O'Day Co-op	360-370 Calumbus Avenue	27 du	121A
Rehab	Rutland, E. Springfield	South End	14 du	Exmpt

Part 2: Anticipated Completions 1983-1986

1983	Office	Location	Magnitude	Tax Status
Conv.	Fish Pier Offices (Massport)		80,000 sf	Tax
Rehab	"GSA Appraisers Store"/Coast Guard	Northern & Atlantic Avenues/Waterfront	105,000 sf	Exmpt
	State Transportation Building	Park Plaza	800,000 sf	Pilot
Conv.	Atlantic Building	390-400 Atlantic Avenue	100,000 sf	Tax
	155 Federal Street		200,000 sf	Tax
Rehab	195-201 South Street		4,400 sf	Tax
Rehab	45 Milk Street	Financial District	66,000 sf	Tax
Rehab	217 Friend Street	North Station	64,000 sf	Tax
Rehab	Chauncy Plaza	68 Essex Street/Chinatown	75,000 sf	Tax
Rehab	Jenny Building	146-150 Milk Street	10,000 sf	Tax
	2 Devonshire Place	Devonshire, Washington Streets	120,000 sf	121A
Rehab	Colonial Building	100 Boylston Street	150,000 sf	Tax
Rehab	Bulfinch Triangle	138 Portland Street	29,000 sf	Tax
Rehab	419 Boylston Street		35,000 sf	Tax
Rehab	Rice Building	10 High Street	80,000 sf	Tax
Rehab	Portland and Causeway Streets	North Station	100,000 sf	Tax
Rehab	168-174 Milk Street	Custom House District	12,000 sf	Tax
Rehab	Baywest	16-24 West Street	23,650 sf	Tax
	Baywest	16-24 West Street	3,500 sf	Tax
1983	Retail			
	City Place (State Transport. Bldg.)	Park Plaza	57,000 sf	Tax
Rehab	Jenny Building	145-160 Milk Street	6,600 sf	Tax
Conv.	Atlantic Building	390-400 Atlantic Ave.	17,000 sf	Tax
	Lafayette Place	Washington Street	300,000 sf	121A
Rehab	45 Milk Street	Financial District	6,000 sf	Tax
	2 Devonshire Place	Washington, Devanshire Streets	20,000 sf	121A
1983	Medical			
	Brigham & Women's Hosp. Research Building	Medical Area	172,000 sf	Exmpt
	North End Comm. Health Center Nursing	Fulton & Richmond Streets/North End	69,000 sf	Exmpt
	Brigham & Women's Hosp. Ambulatory Service	Medical Area	98,000 sf	Exmpt
Rehab	N.E. Medical Center Biwend Building		70,000 sf	Exmpt
1983	Cultural			
	Shipyards Park Phase 2 (Pier 4 Marina)	Charlestown Navy Yard	20 Boats	Exmpt
	Shipyards Park Phase 1	Charlestown Navy Yard	4+ Acres	Exmpt
1983	Transportation			
	Brigham & Women's Hospital	Medical Area	400 Cars	
	State Transportation Building	Park Plaza	330 Cars	
	Building 30 Site (EDIC)	BMIP	200 Cars	Pilot
	2 Devonshire Place		250 Cars	121A
	Copley Place (Westin Hotel)	Copley Square	275 Cars	Tax
	Lafayette Place		1,050 Cars	Exmpt
1983	Industrial	Location	Magnitude	Tax Status
Rehab	Fish Pier (Massport)		143,000 sf	Tax
	Purolator/Courier (EDIC)	BMIP	36,000 sf	Pilot
Conv.	Teradyne Expansion (BRA)	1000 Washington Street	323,000 sf	121A
Rehab	Advanced Electronics (EDIC)	106-112 Beach Street/Chinatown	30,000 sf	Tax
Rehab	Au Bon Pain (EDIC)	BMIP	12,000 sf	Pilot

Rehab	Chadman, Inc. (EDIC)	595-603 Newbury Street	20,000 sf	Tax
Rehab	Stevens-Arnold (EDIC)	7 Elkins Street	69,000 sf	Tax
Rehab	Pandick Press Inc. (EDIC)	647 Summer Street	60,000 sf	Tax
	Intn'l Ice Cream/Mobiles Corp. (EDIC)	492 Rutherford Avenue	10,500 sf	Tax
Rehab	Donelle Ltd. (EDIC)	137 South Street	13,000 sf	Tax
Rehab	House of Bianchi (EDIC)	168 A Street	26,000 sf	Tax
1983	Hotel			
Westin	Hotel	Copley Place	804 Rooms	Tax
1983	Residential			
Rehab	E. Canton Street	East Canton Street	80 du	121A
	Robert L. Fortes		41 du	121A
Conv.	Sleeper Street & Congress	Fort Point Channel	88 du	Tax
Conv.	Mt. Vernon Church	492 Beacon Street	40 du	Tax
Rehab	Beacon Chambers	Myrtle & Joy Street	143 du	121A
	Bradford Towers Associates	South Cove	229 du	121A
Rehab	On Luck Housing (Congregate)	25-31 Essex Street	28 du	121A
	2 Devonshire Place	Milk, Devonshire Streets	478 du	121A
1984	Office			
	Copley Place	Copley Square	845,000 sf	Tax
Rehab	71 Summer Street		10,100 sf	Tax
	Dewey Square	South Station Area	1,050,000 sf	Tax
	One Exeter Place	699 Boylston Street	190,000 sf	Tax
	303 Congress Street	Fort Point Channel	68,000 sf	Tax
	399 Boylston Street		195,000 sf	Tax
Rehab	Warren Chambers Building	Boylston Street	35,000 sf	Tax
Conv.	Charlestown Navy Yard Bldg. #36	Charlestown Navy Yard	43,601 sf	Lease
Rehab	Hancock Clarendon Bldg.	197 Clarendon Street	379,000 sf	Tax
Rehab	Boylston Building	Boylston & Washington Streets	58,200 sf	Tax
Rehab	Yonkee Building	31-35 Union Street	30,000 sf	Tax
Rehab	Exchange Place (Stock Exchange Bldg.)	53 State Street	80,000 sf	Tax
	Exchange Place	53 State Street	1,000,000 sf	Tax
	265 Franklin Street	Franklin and Oliver Streets	320,000 sf	Tax
1984	Retail			
Rehab	71 Summer Street		2,400 sf	Tax
	Copley Place	Copley Square	375,000 sf	Tax
	Dewey Square (Retail/Theatres/ Rests.)	South Station	20,000 sf	Tax
	399 Boylston Street		14,000 sf	Tax
Rehab	Warren Chambers Building	Boylston Street	4,400 sf	Tax
Conv.	Charlestown Navy Yard Building 36	Charlestown Navy Yard	18,732 sf	Lease
	One Exeter Place	699 Boylston Street	20,000 sf	Tax
Rehab	Chinagate Grocery, Restaurant	7-15 Beach St./Chinatown	3,000 sf	121A
Conv.	Prince School	201 Newbury Street	21,000 sf	Tax
Rehab	Boylston Building/China Trade Center	Boylston & Washington Streets	31,900 sf	Tax
Rehab	Exchange Place (Stock Exchange Bldg.)	53 State Street	20,000 sf	Tax
1984	Medical			
	Tufts U. Health Science Education Bldg.	Harrison and Harvard Streets		Exmpt
	M.G.H. Wellman Research Building	West End	128,000 sf	Exmpt

1984	Cultural			
Rehab	Metropolitan Center (Phase II) Shipyards Park Phase 3 (Drydock Promenade)	Theatre District Charlestown Navy Yard	4,200 seats 7 Acres	Pilot Exmpt
1984	Transportation			
	Dewey Square	Atlantic/Summer/Essex	260 Cars	Tax
	Parking Garage (Retail Arcade)	Copley Place	1,157 Cars	Tax
	Four Seasons Hotel and Condo Parking	Park Plaza Phase II	220 Cars	Tax
Conv.	Bldg. #199	Charlestown Navy Yard	1,281 Cars	Lease
1984	Industrial			
	H.P. Hood, Inc. (EDIC)	500 Rutherford Avenue	100,000 sf	Pilot
Rehab	H.P. Hood, Inc. (EDIC)	500 Rutherford Avenue	562,000 sf	Pilot
Rehab	Pier 6 (EDIC)	BMIP		Pilot
Conv.	Bldg. 114 Boston Army Base Phase 1 (EDIC)	666 Summer Street/BMIP	875,000 sf	Pilot
1984	Hotel	Location	Magnitude	Tax Status
	Marriott	Copley Place	1,145 Rooms	121A
	Four Seasons Hotel	Park Square	289 Rooms	Tax
Rehab	Sheraton Boston Renovations	Prudential Center	1,430 Rooms	121A
	Intercontinental Hotel	Lafayette Place	500 Rooms	121A
Rehab	Hotel Essex	Atlantic Ave. & Essex St./South Station	200 Rooms	Tax
1984	Mixed Use & Other			
Rehab	Boscom (Massport)	Commonwealth Pier	1,100,000 sf	Tax
1984	Residential			
Conv.	Dan Basco Electronic School	Tremont-Oak-Washington Streets	280 du	121A
	Copley Place	Copley Square	125 du	Tax
	Four Seasons (Condo)	Park Plaza	100 du	Tax
Conv.	Philip H. Sheridan School	1 Prescott Street	24 du	Tax
Conv.	Old Charlestown High School	30 Monument Square	45 du	Tax
Conv.	Quincy School	90 Tyler Street/Chinatown	7 du	Tax
Conv.	Prince School Condos	201 Newbury Street	36 du	Tax
Conv.	Rice School	130 Appleton Street	42 du	Tax
Conv.	Bancroft School	150 Appleton Street	24 du	Tax
Conv.	Sharp Elementary School	65 Anderson Street	12 du	Tax
Rehab	Chinagate Housing Assoc.	7-15 Beach Street/Chinatown	15 du	121A
Conv.	Warren Quarters (Elderly) (Bldg. #103)	Charlestown Navy Yard	110 du	121A
1985	Office			
	Marketplace Center	200 State Street	273,000 sf	Mixed
	Constitution Plaza (Massport)	Hoosac Pier	160,000 sf	Pilot
	260 Franklin Street	Franklin And Oliver Streets	300,000 sf	Tax
Conv.	Building 33	Charlestown Navy Yard	21,800 sf	Lease
Conv.	Building 34	Charlestown Navy Yard	17,000 sf	Lease
1985	Retail			
	Marketplace Center	200 State Street	64,000 sf	Mixed
	260 Franklin Street	Franklin and Oliver Streets	5,000 sf	Tax
	Constitution Plaza Restaurant (Massport)	Hoosac Pier	10,000 sf	Pilot
Conv.	Building 33	Charlestown Navy Yard	10,940 sf	Lease
Conv.	Building 34	Charlestown Navy Yard	8,500 sf	Lease
1985	Medical			
	M.G.H. Addition (Bartlett Hall)	West End	26,000 sf	Exmpt

1985	Educational			
Conv.	Emerson College Theatre (Old Saxton)	Tremont Street	1,000 Seats	Exmpt
1985	Cultural			
	Museum of Boston at Marketplace Center	200 State Street	30,000 sf	Mixed
Rehab	Museum of Fine Arts Evans Painting Wing	Huntington Avenue	100,000 sf	Exmpt
Conv.	North End Museum (Lincoln Wharf)	Battery and Commercial Streets	6,500 sf	Tax
	Shipyards Quarters Marina Phase II	Charlestown Navy Yard	400 Slips	121A
	Shipyards Park Phase 4 (Pier 3 Bulkhead)	Charlestown Navy Yard	275 Ln. ft.	Exmpt
1985	Transportation			
Conv.	Independence Quarters (Bldg. #197)	Charlestown Navy Yard	134 Cars	
	Canklin Development Corp.	Washington Park	125 Cars	
	260 Franklin Street	Franklin and Oliver Streets	160 Cars	Tax
	Tent City/Copley Place	Dartmouth Street	1,100 Cars	
	Marketplace Center	200 State Street	123 Cars	Mixed
1985	Industrial			
Conv.	Bldg. 114 Boston Army Base Phase 2 (EDIC)	666 Summer St./BMIP	875,000 sf	Pilot
	N.E. Nuclear Expansion Phase I	594 Albany Street	60,000 sf	Tax
Rehab	Bldg. #149 Charlestown Navy Yard	Charlestown Navy Yard	725,200 sf	
	Wang Laboratories	Kneeland Street	100,000 sf	Tax
1985	Residential			
	Tent City	Dartmouth St., Columbus Ave.	300 du	
Conv.	Independence Quarters (Bldg. #197)	Charlestown Navy Yard	141 du	121A
	Independence Quarters Townhouses	Charlestown Navy Yard	13 du	121A
	Shipway Quarters Phase 1	Charlestown Navy Yard	21 du	121A
	Shipway Quarters Phase 2	Charlestown Navy Yard	27 du	121A
Rehab	Clarendon-Warren	4-18 Clarendon St., 72 Warren Ave.	30 du	
Rehab	West Newton-East Concord	35-36 W. Newton St., 10-34 E. Concord St.	30 du	
Conv.	Lincoln Wharf Condos (San Marco)	357-371 Commercial Street	191 du	Tax
	Cathedral (BHA)	Washington Street	9 du	Exmpt
Rehab	Cathedral (BHA)	Washington Street	58 du	Exmpt
1986	Office	Location	Magnitude	Tax Status
	Arlington/Hadassah Way	Park Plaza	90,000 sf	Tax
Rehab	Summer, Hawley and Arch Streets	Downtown Crossing	30,000 sf	Tax
	Kennedy's Building*	Summer, Arch, Hawley, Franklin Streets		Tax
	G.S.A. Federal Office Building	North Station	630,000 sf	Exmpt
Conv.	Building 38	Charlestown Navy Yard	17,000 sf	Lease
Conv.	Building 39	Charlestown Navy Yard	41,770 sf	Lease
	Rawes/Fasters Wharves	Waterfront	225,000 sf	Mixed
	Downtown Garage Sites*	Ft. Hill Square, Kilby St. St. James Ave., Govt. Center		Mixed

1986 Retail

Rehab	Summer, Hawley and Arch Streets	Downtown Crossing	30,000 sf	Tax
	Arlington St. & Hadassah Way	Park Plaza	50,000 sf	Tax
	Kennedy's Building	Summer, Arch, Hawley, Franklin Streets		Tax
	G.S.A. Federal Office Building	North Station	22,000 sf	
Conv.	Ind. Quarters Restaurant (Bldg. #197)	Charlestown Navy Yard	5,000 sf	121A
Conv.	Building 38	Charlestown Navy Yard	8,500 sf	Lease
Conv.	Building 39	Charlestown Navy Yard	20,880 sf	Lease
	Rowes/Fosters Wharves	Waterfront	14,500 sf	Mixed
	Downtown Garage Sites*	Ft. Hill Square, Kilby St. St. James Ave., Govt. Center		Mixed

1986 Educational

	Museum School Addition	Museum Of Fine Arts	55,000 sf	Exmpt
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1986 Cultural

Rehab	Opera Company of Boston Phase II	Washington Street	2,600 Seats	Tax
	Waterfront Walkway	Rowes/Fosters Wharves	2 + Acres	Mixed

1986 Transportation

	Federal Office Building	North Station	1,500 Cars	Exmpt
	Arlington St. & Hadassah Way	Park Plaza	350 Cars	Tax
	Boat Terminal	Rowes/Fosters Wharves	8,000 sf	Mixed
	Rowes/Fosters Wharves	Atlantic Avenue/Waterfront	400 Cars	Mixed
	Downtown Garage Sites*	Ft. Hill Square, Kilby St. St. James Ave., Govt. Center		Mixed

1986 Residential

Conv.	Intrepid Quarters (Elderly) (Bldg. #104)	Charlestown Navy Yard	55 du	121A
	Arlington St. & Hadassah Way	Park Plaza	150 du	Tax
	Rowes/Fosters Wharves	Waterfront	250 du	Mixed

* Projects under review by the BRA.

Source: Boston Redevelopment Authority, 1983.

Fall 1983

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